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MENTAL CAUSES OF ACCIDENTS

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MENTAL CAUSES OF ACCIDENTS

BY

BOYD FISHER

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PREFACE

Writing a book is, of course, an educational experience. The author always comes out of it knowing much more than when he went in. It is a poor subject, indeed, that does n't broaden and deepen before the delighted eyes of the writer as he gives months to a close examination of its meanings and relations.

The pleasure which I found in the development of this theme grew out of the fact that a topic, which began as a limited study of the mental causes of accidents for the instruction of safety men, quickly unfolded itself as a peculiarly direct and revealing approach to the whole problem of psychology in industry. The minds of men disclose themselves only in action. A text on psychology may be formulated in terms of general principles and theories without reference to the particular actions which gave rise to these generalizations. But actions, often dramatic actions — the amusing, pathetic, or tragic struggles of real human beings to find comfort and happiness — were the only source of information for these dry-as-dust formulæ. Just as the drama is a highly useful device for teaching and for public discussion, so the dramatic incident is the best material for the study of mental laws. To give the reader a reconstructed action as the basis for a theory is not alone to render the subject easy and interesting for him, but also to permit him to form his own theories in coöperation with or opposition to the author.

An accident is the most dramatic and informing occurrence of factory life. It happens only as the result of some interruption of routine — human nature breaks through, so to speak, and shows itself in some fashion that all may comprehend. And in the unprompted reactions of the victim after he has been hurt, the doings of fellow workers, of bosses, and of the sufferer's family, there are often further interesting disclosures of minds off guard.

It is apparent, therefore, that any adequate inquiry into the mental side of industrial accidents will come close to being a well-rounded study of psychology in industry. If it lose anything by being restricted to the discussion of accidents, it is likely to compensate by the vividness of its material.

If regarded only as a phase of the subject, accident prevention is certainly the most practical approach to psychology in industry. Production men have, perhaps with good reason, been rather skeptical about the theories of the mental testers, social welfare experts, and psychiatrists, and have hesitated not only to buy, but even to use their services. But, by State law, industry is taxed for accidents and rewarded for reducing them. So much of psychology as is useful in securing lower insurance rates has a definite money value, and no practical man will exclude it from his favor.

If industry will go only so far, the psychologist will be content. The scientist asks only a chance to demonstrate. He knows how economical, after all, is truth — with how little change or adaptation he can transfer his efforts from one object to another. Little is required for mental testing and for mental hygiene that will not have been rendered familiar for accident prevention. Indeed, Dr. George K. Pratt, of the Massachusetts Society for Mental Hygiene, who has read and helpfully criticized this essay, has stated his conviction that accident prevention, from the psychological side is the best entering wedge for mental hygiene in industry.

It is the writer's hope that, being himself an industrial man, he has been able to make this book interesting and familiar for safety men, foremen, and members of safety committees. It is his expectation, furthermore, for the reasons already given, that it will be useful as text material for classes in applied psychology and in industrial relations. In the belief that some practical men will find in this discussion a stimulus to further study in psychology, I have added a supplementary chapter on what to read in psychology.

The thanks of the author are due to Mr. W. H. Cameron and to Mr. Sidney J. Williams, of the National Safety Council, to Mr. E. M. Very, editor of *Builders*, for literary criticism; to Dr. A. B. Emmons, 3d, of the Harvard Medical School, to Mr. Hilton Howell Railey, and to Miss Marion Myers, for statistical help.

FOREWORD

MANY of the sponsors for the Safety Movement in America — the men supervising the safety problems in the workshops and in public places — have lamented the absence of a psychological study of the fundamental problem of safety education. The safety man in the plant has felt the need for an interpretation of the mental attitudes of his associates and workers — to understand the root causes of seemingly inexplicable mind actions and reactions to working conditions that cannot be solved by mechanical formulas. Many of these safety leaders have been puzzled in understanding the mental attitude of these men who get hurt or killed, and they have had difficulties in planning their educational programmes to encourage the individual to react fearlessly and automatically toward safe practices.

Mr. Boyd Fisher's book is a distinctly new contribution toward the study of accident causes and will be an invaluable aid to students and to safety men on the jobs. Every one interested in understanding the mental problem of the individual, who should be interested in his own safety, should own and read a copy of this book.

W. H. Cameron
Managing Director
National Safety Council

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where you would expect it to be, it was well lighted and guided by a hand rail. The steps were wide enough and covered with safety treads. Surely, it had no hazard in itself; and yet clerks, perfectly familiar with the fact that others had been injured there, and accustomed to using the stairs every day, on several occasions plunged headlong the whole length of the flight. We held many indecisive conferences at the Aluminum Castings Company about these stairs, which seemed to have the very devil in them. One day we happened to measure the width of the steps to compare with another flight. We were surprised to learn that the first step below the landing was two inches wider than all the rest below it. The secret was then out. A girl would take her first step down, looking where she put her foot, and adjusting it to the usual position on the edge of the step. Subconsciously she noted the width, and assumed that all of the other steps were exactly as wide. Then she placed her foot on the next lower step two inches too far forward, lost her balance, and came tumbling down to the bottom.

The remedy, of course, was to extend the landing out two inches so that the steps were, then, all of the same width. But, granting the necessity of doing that, one could not properly say that the steps were wrong. Taken singly, they were all right. The cause of the accident really lay in the subconscious mental operation of the person using these stairs. And this case is suggestive of many situations in which accidents occur because a perfectly normal automatic assumption by the mind does not accord with the realities.

C. R. Lobs, the safety man of the Midvale Steel Company, has said, "The big percentage of accidents falls in that class where the difficulty, and the manner of correcting it, lie in the man's mind." Mr. Lobs has substantiated in his own experience the oft-stated fact that 70 per cent of the accidents are traceable directly to the worker's fault. As he divides them up further, he finds that 60 per cent are directly the blame of the man hurt; 10 per cent, a fellow workman's fault; 29½ per cent, "nobody's fault," and only one-half per cent the company's fault. He goes on to classify the types of faults of workmen, as —

Failed to use provided safety device.
Failed to use proper tool or appliance.
Improper method of doing work.
Violation of rules, such as, operating the wrong machine.
An improper act.

If we consider those cases where "the cause of the accident and the manner of correcting it lie in the man's mind," as being *faults* of the worker, and subject to blame or discipline, then perhaps we can rightly say that the company is responsible only for one-half per cent of the accidents.

But are mental errors culpable? Are we to blame for our minds? The laws of most States not only hold manufacturing companies liable for accidents occurring on unguarded machines, but also require them to provide safeguards. Is n't it possible to consider poorly equipped minds as unguarded machines?

In the matter of industrial accidents, we seem to take for granted that the 70 per cent of men who get hurt of "their own fault" do so willfully. We set the cause down always as "carelessness" — which means that we assume that they *knew* better, but deliberately went wrong. It would be reasonable, if this were so, to punish them, or, at least, to deny them compensation. Indeed, until recently they *were* denied compensation. Under the common law, workmen could always get restitution for injury which was clearly established as the fault of the employer. They were denied redress, however, when there was "contributory negligence," or fault of a "fellow servant," or, sometimes, "assumption of risk" by the employee. These defenses, allowed the employer, were based upon the conception of a workman's presumed knowledge of the sources of danger and his duty to avoid them. If it were reasonable to hold the worker responsible in such cases, the Workmen's Compensation Acts, which require employers to pay for *all* injuries, are unjust. Perhaps, in some cases, theoretically, they are — it is idle to debate that question; but the point to note here is that the law seems to assume that men are not always responsible for their own acts.

Of late years this assumption has been making headway in dealing with delinquents in general. Not only has the insanity plea in murder cases been allowed in an ever-widening range of circumstances, but the degree of moral responsibility for crime has been weighted in many other respects. We see it in the classification of prisons — one for first offenders, another for feeble-minded criminals, another — called a reform school — for youthful offenders, another for wayward girls, and so on. We see it in the amelioration of the sentence for crime, through the juvenile court system, through the parole system (which deals with an unbelievable proportion of offenders), and through the indeterminate sentence system.

The reason and justification for such leniency are found in the accumulating statistics on the relation between crime and feeble-mindedness, insanity, and other causes beyond the immediate control of the wrong-doer.

Dr. Walter S. Fernald, of the Massachusetts School for Feeble-Minded, estimates that "at least 25 per cent of the inmates of our penal institutions are feeble-minded."[1] Various surveys of the white-slave traffic estimate that from 40 to 60 per cent of this class of women are defectives.

Dr. William Healy, in an analysis of the cases of 668 juvenile offenders, who came before him in the Chicago juvenile court, found that mental defects or mild forms of insanity were responsible for 35 per cent of the cases, and contributory in 9 per cent more. "Faulty environment" made up most of the other causes, and, since a child, at least, is not responsible for his environment, nearly all of Dr. Healy's cases warranted another type of treatment than mere punishment.[2]

[1] Michael F. Guyer, *Being Well Born* (Ind. 1920), p. 266.
[2] William Healy, *The Juvenile Delinquent* (Boston, 1920), p. 158.

THE UNGUARDED MIND

When mental unsoundness is recognized as just ground for discriminating between offenders against the law, have we not good reason, also, to recognize the existence of such grounds in the matter of accidents? Perhaps we have been taking too much for granted about the capacity of workers to take care of themselves. Our safety methods have all been based upon the presumed need of bringing home to workers a sense of responsibility — or of scaring them into looking out for themselves.

It is time that we took a hint from the progress which has been made in dealing with other forms of social difficulty, and treated accidents, not as delinquencies, but as forms of mental error. The mental factors in accidents may be made known, and, where they can be corrected and are not counteracted by mental safeguards, at least part of the blame for accidents which they cause should be assumed by the employer. Merely to say that a workman "failed to use the proper safety device" does not sufficiently analyze the situation. If possible, we must get at and correct the state of mind which produced this error.

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The man who gets hurt. If ten men are vaccinated at one time, there will be perhaps three with whom the operation will not "take." Of any number of people exposed to a contagious disease, a portion will succumb to it, and others will remain immune. So, too, with mental influences. Not all men can be moved by the same causes. In the matter of accidents, there are men who appear to be born unlucky, because, without especial demerit, they are always getting hurt. We ought not to proceed to the analysis of the reasons why men fall into error without pointing out that there are certain types of men who are especially susceptible of error.

Oftentimes they are extremely able, responsive, and conscientious men, not the sort whom we should be likely, in advance, to brand as accident risks. But it is nevertheless true that there are particular temperaments which are not safe, or which require special treatment to be kept safe.

There have been attempts to discover whether particular race inheritances produce any noticeable effects on the accident rate, but to date no tables have proved that one race has any advantage over another in this regard. It has been shown that Jewish people suffer from two to three times as much from diabetes as any other race, because of their nervous temperaments and their openness to worry. This might be thought symptomatic of a tendency to get hurt, as the result of acting excitably. And yet, there appear to be offsets which equalize any such tendency, if it exists.

There does exist an age tendency to accident. Very young or very old workers are injured more frequently than middle-aged ones. Men from 20 to 29 years old get hurt more frequently than men from 30 to 39 years old. In a period of five years in a large steel plant Chaney and Hanna reported[1] that men in the younger group sustained, yearly, 177 accidents per 1000 300-day workers, as against 162 per 1000 among the older group, and that in another plant the accident frequency among the younger men was 234.2 per 1000 against 178.7 per 1000 of the older group. Other tables point

[1] *The Safety Movement in the Iron and Steel Industry,* U.S. Bureau of Labor Statistics, Bul. 234.

to the same conclusion — that immaturity is a direct contribution to accident.

The special accident liability of old men is indicated in all tables of accidents by length of service groups. Note the tables given in Chapter II, which seem to indicate a rising accident rate after 30 or more years of service.

And so it is not strange that the men of any age who are most likely to get hurt are those whose temperaments are most like either the qualities of youth — responsiveness, excitability, and hastiness — or most like old age — sluggishness, indifference, and laggard reactions. "The best safety device is a safe man," it has been said, and the safe man appears to be one who is neither so quick on the trigger that he reacts to the slightest stimulus, nor so dull as to fail to respond promptly.

There is a very wide temperamental variation in excitability due to the physiological differences between individuals. Dr. Walter B. Cannon, in his epochal book, "Bodily Changes in Pain, Hunger, Fear and Rage," has demonstrated that these emotions stimulate the discharge into the blood of an internal gland secretion, a chemical substance called "adrenin." He has proved that this chemical stimulates increased circulation, causes the liver to throw into the tissues an excess of sugar — the most energizing food — and excites all of the nerves which control voluntary activity. At the same time, it hinders digestion, and inhibits all of the other involuntary activities in order that the entire energy of the body can be utilized, under central direction, to meet the situation of danger or need which has given rise to these emotions. Adrenin seems to have a specific effect, too, in overcoming fatigue during the period of excitement.

Some individuals have an excess of function in the adrenal glands, and if they permit emotions to rouse them, or often find themselves in situations where emotions are kindled, they are in a constant state of excitement, of highly mobilized energy, ignoring fatigue, moving spasmodically, and, most likely, with undue haste and precipitation.

Excitement may be only temporary; excitability is temperamental. It is not always linked up with emotionality, for we often see persons of excellent emotional control and calmness who respond with great and instant bodily energy to such stimulations as they do permit to affect them. It is apparently always linked up, however, with quick and sensitive nervous responses. So, where the emotions are well controlled, and the aroused energies are guided by high intelligence and caution, there is no temperament which can be more safely trusted in dangerous places than the man of quick reactions. But where the intelligence is muddy and confused, and the emotions are permitted to exhaust the energies, as is usually the case with the highly responsive temperament, we get a condition of dangerous excitability. There will be, also, superseding periods of depression, due to the overstrain and the necessary relaxation for repair of forces. Such a person is always on the threshold of agitation or despair, using up instantly and in futile efforts his bodily energy as soon as it is generated. He becomes nervous, irritable, and weary. He seems always to be behind time, and always under pressure. Always late, he is always hurried, so that by habit he becomes precipitate and thoughtless. He first acts and then reflects. Deliberate forethought becomes impossible. It irks him to contemplate it. With him, to imagine is to desire, and to desire is to act. Fears are translated into impulses and impulses into performances — often into accidents.

Such persons are, of course, especially sensitive to reproof, and, because of their hasty dispositions, more often merit it, so that they are constantly harried by their unfortunate blunders. Their usual recourse is to drift into occupations of a clerical, routine nature, or work that permits them a certain amount of isolation. By such defensive withdrawals from conflict they avoid excitement and find peace. But where they have to remain on jobs that keep them stirred up, they are a decided accident risk.

Corresponding to the over-active temperament we have the stupid or phlegmatic one. This type is nearly as dangerous as the other, because it is so slow to respond that it cannot "step lively" in dangerous situations. Temperamental sluggishness to the degree which is dangerous, however, is very seldom seen in persons of normal intelligence. Abnormal slowness to react is usually a part of the deterioration of old age, or else a phase of depression from disease, fatigue, or insanity. It will, therefore, be considered under those heads.

And there is, of course, a third type of man whose tendency to accident is general and inborn — the deficient of intellect. He is an unsafe man because he cannot easily learn or be taught how to take care of himself, and in critical situations he is wholly lacking in judgment. We shall speak further of him, later on. Now it is sufficient to point out that the low-grade mentality, along with the very immature, the very old, and the temperamentally excitable or phlegmatic, forms a class of people who get hurt because they are not safe men. If they are not entirely eliminated by initial selection, they must be carefully assigned to suitable tasks and especially protected against their own tendencies.

In most other cases, the mental errors which result in accident grow out of particular situations which may be altered, occasional events that may be avoided, individual traits or attitudes that may be corrected, or peculiarities in the employee that may be compensated for. In other words, the man whose whole bent is unsafe must be considered separately and treated differently from the man whose errors may be related to special and removable causes.

Real and apparent mental causes of accidents. The great majority of injuries result from falls, stumbling, mishaps with hand tools, and failure to get out of the way of moving trucks, cranes, and other vehicles. Unguarded machines, falling objects, insecure staging or scaffolds, and other faulty working conditions do create sufficient havoc, but care in respect to mechanical safeguards is not sufficient to protect workmen. In an investigation of 100,708 accidents, the United States Steel Corporation found that 44.93 per cent occurred in hand labor, where no safety device could be furnished.

Most accidents, of course, are of a minor nature, such as those due to splinters, pinpricks, nail wounds, scratches from loose wires, or from tools, contusions, as from hammer blows, tripping on loose boards, slipping on wet floors. In almost every case, no mechanical safeguard could have been provided. Another important group of accidents occurs on machines where guards have been provided, or where safe rules of operating have been formulated, but where the men injured have removed the safeguards or disregarded the operating rules. An oiler, for instance, was lubricating a shaft five feet above the floor. He had rolled up his sleeve, but it had unrolled, and hung loose. He attempted to give the shaft a bit of attention while it was in motion. His sleeve caught and he was hurled around the shaft three times. His injuries caused fourteen months' lost time and permanent disability. Another employee deliberately removed the protection from an emery wheel and failed to wear his goggles while grinding a small tool. The wheel was cracked, and at the moment happened to fly into pieces, with the result that the man lost an eye.

Clearly, such accidents are due to the "human element." Just as clearly, they involve a mental cause which it will repay us to study, if we can only discover it. It is possible that the list of mental causes of accidents which I propose to analyze is a complete and accurate appraisal, and yet there might be, at the same time, great difficulty in connecting up any given accident with the right mental cause. What the safety man has a right to ask is not only a set of pigeon-holes into which to classify accidents by mental causes, but also some kind of system for sorting out his accident cases to get them into the right pigeon-holes.

A man stumbles and falls. Perhaps it was due to some basic mental factor. But how are you going to discover which one? Does the man himself know? Is n't every accident unique; is n't it due to a peculiar set of circumstances, a temporary mental condition that just happened, and which, if it had come at any other time or place than when and where the accident occurred, would have caused no trouble?

The answer to such queries is not to be found in any set of fundamental accident causes alone, because we have to deal also with a set of apparent or proximate causes.

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If we should take for analysis any given set of one hundred accidents, of which we knew all of the attendant circumstances, and set down in writing the immediate situation of the man hurt, we should get statements something like the following:

"He was running to shut off the power on a picker which had caught fire inside, and slipped on the floor and cut his forehead on the end of a lap-rod."

"Jones was cleaning a mule spinning frame which was inadvertently started up by another hand. The frame had been stopped on the way in instead of on the way out, and he was caught before he could get out."

"The oiler was in a hurry to get home for the day, and failed to secure the ladder properly."

And so on. In most cases no strictly mental feature would show up on first examination. Haste might be cited as a cause in two of the above cases, and, assuredly, hurry is a mental state. But is not the cause of hurry usually something external and cannot an infinite number of things cause a man to hurry?

Or, in the case of the man caught in the mule spinning frame, we might say that another man could have got out in time, and that this one is mentally slow. But is n't there something back of his being caught in the frame at all, which is more truly the cause of the accident?

And so, if we went on and analyzed the entire one hundred accidents, we should be likely to feel considerable doubt of our preliminary mental diagnosis. It would be possible, however, to simplify the confusion somewhat by sorting them roughly into these various classes:

1. Cases where the victim was hurried; where he was n't given or did n't take time to think, or where, in his haste, he was led to omit some necessary step, or slight some safeguard.
2. Cases where the victim was too slow; where he did n't react quickly enough to get out of the way of danger when warned.
3. Cases where the victim showed lack of judgment — through confusion, ignorance, or neglect.

While these are, all three, mental classifications, we cannot rest content with these diagnoses, because they are not diseases, but symptoms; they present us with nothing we can cure. Hurry may be only spasmodic; the steadiest man loses his head sometimes. Slowness is only relative. Merely failing to "beat the machine to it," so to speak, counts for little as a mental trouble, because on a slower machine the accident might not have happened. And it is idle to stigmatize bad judgment, because judgment cannot be cultivated as a mental faculty. It is always appraised in relation to a given situation, and consistently good judgment is a by-product of experience. Indeed, it includes so many mental elements that it is almost a synonym for successful adjustment to the environment. We cannot always be sure, in any given case, what is good or bad judgment, save by the evidence of success or failure.

The value of making, nevertheless, such a provisional classification lies in the fact that, roughly speaking, it does make the first main subdivision. Generally, being too slow or too fast does not involve judgment, but situation. In such cases, not so much a wrong decision as lack of *any* decision brings on the trouble. And a too rapid action usually points to a very different set of possible mental causes from those indicated by a laggard motion.

Viewing the causation of accidents the other way round, we shall see that none of the fundamental mental causes operates, in itself, to cause an accident. Excitement, for instance, growing out of mental disease, cannot hurt a man, but a hurried movement growing out of excitement can cause an accident. Fatigue, or disease, or depression from worry, cannot in themselves cause accidents, save as they cause a man to move too slowly to get out of the way of trouble, or cause his judgment to be poor.

It would be tedious here to trace back all of the precedent causes of hurry, lag, or poor judgment, which show up as apparent causes of almost any avoidable accident. We shall rather go directly on to the more fundamental causes, and, as we deal with them, indicate how they affect the immediate behavior of the victim of accident. But at no time ought we to forget that there are both immediate or proximate causes of accidents — such as hurry, lag, and poor judgment — which can only be dealt with by tracing back to more fundamental errors; and that basic mental troubles are likely to obscure themselves behind these immediate causes.

The main outlines of this analysis. The distinctions between various mental causes of accidents made in this book are perhaps faulty in some respects — very likely arbitrary. As this essay appears to be the first attempt to embrace in a single classification all the mental factors which may affect the man who gets hurt, it is necessarily provisional and limited by the personal capacity of a single investigator. Yet there appears to be some logical consistency and a certain appearance of completeness in the arrangement.

Fifteen major causes of accident are dealt with, and these are susceptible of grouping under five heads: ignorance, predispositions, inattention, preoccupation, and depression. These words do not immediately tell the story, but they are useful words to sum up what I shall say more fully. They are, furthermore, classifications which may stretch over the whole field of mental error.

Ignorance, by derivation, means simply not knowing. As a source of accidents, ignorance means lack of necessary information or of capacity to understand information about dangerous processes. A workman may not know because of not having been told, or of not understanding the English language, or of not having the mental faculty for comprehending what he is told. When a workman's wits are puzzled, safety is accidental. We shall look into these three sources of ignorance in Chapter II.

Predisposition is a more active condition directly opposed to safe practice. It might be set down as a wrong bent, a state of mind, which, however innocent of blame, leads one to getting into the way of trouble. This mental attitude is more difficult to deal with than ignorance, because it's knowing what "ain't so." Or it may be just a lifetime accumulation of ideas and habits which shut the door on new and valuable information. A man who cannot trust his own senses, or whose ideas and habits stand in the way of his intelligence, is an unintentional accident risk. We shall consider in Chapter III those sense defects which misguide the mind by furnishing it, so to speak, with insufficient or false information. In the chapter on "The Stubborn Mind," three other types of predisposition to accident — faulty attitudes, temperamental excitability, and subconscious errors — will be dealt with. The fourth form of predisposition — faulty habits — has a chapter to itself. We may note even at this point, however, that when we put men to work who are ignorant of their dangers, or who are already in a mental condition in which they tend willy-nilly toward an unsafe mode of conduct, we can hardly complain that the Workmen's Compensation Acts hold us responsible for any injuries *they* sustain.

Inattention, which is dealt with next, is simply the state of being otherwise engaged — "nobody home" — a condition in which a normal, healthy mind and a normal, healthy body with no predisposing faculty for getting hurt are engaged in other business when the test comes. In the chapter on "The Diverted Mind," we shall see that safety is a by-product of interest in the job, and that while the workman may be held at fault for letting his mind wander, yet management has it in its own power so to interest and so to preserve the equanimity of workers that their minds will not wander.

Preoccupation means the surrender of the mind to claims of feeling or mental habits which are stronger in their influence than anything in the present situation. It is an emotional hang-over from some situation or physical condition which continues to excite the mind, even after the crisis has passed. It interests us with relation to accidents because so often the worker imports into the plant with him part of the drama of his life outside, re-enacting his own difficulties at a time when he ought to be putting his mind on his work. It may be only an emotional strain or it may be out-and-out insanity, but whatever the degree of preoccupation, a mind which is not "to let," so to speak, for new mental tenants, not ready to meet the situations that come up currently, is a mind predisposed to accidents. We shall speak of this further in the chapter on "The Troubled Mind."

Depression is a medical term for what is sometimes also called psycho-motor retardation, and for which the plain English is sluggishness or torpor. This is a physical or mental state in which one's functions are inactive, his reactions laggard, his understanding blurred, and his responses tardy. Temporarily he is depressed to a lower state than normal. He is predisposed to accident, for the time being. In the chapter on "The Physical Mind," we shall examine some of the ways in which disease, drugs, and faulty plant conditions may produce depression, and, in the chapter on "The Tired Mind," offer some opinions on so-called "fatigue."

It may occur to the critical reader to ask why there is not a classification for "excitement," set off against "depression," as the logical opposite of sluggishness. Our reply must be that, whereas depression can be a settled, persistent thing, and, in its various subdivisions, a fundamental mental condition, excitement is temporary and symptomatic. As we have already seen, when it is chronic, it is temperamental, as excitability, and we shall have to consider it, then, under the head of "predispositions," along with faulty attitudes, as a "mental set." When excitement is merely acute and occasional, it may be due to distractions in the environment, to disease, to worry, or to mental derangement, and should be regarded as one of the aspects of these troubles.

CHAPTER II

THE PUZZLED MIND

Hunkies. Did you ever see in some factory yard a complicated electrical apparatus with a fence around it, and a sign marked "Danger — 2200 volts"? You could n't *see* the volts, or guess just where they were kept. You merely felt that if they were dangerous, you were glad that they were fenced in, and you considered it prudent to stay outside of the fence.

But what if you were required to go inside of the fence and work around the mysterious colony of volts? Would a mere danger sign tell you how to keep them from biting you? You would probably demand a few further instructions before even touching the fence. You would want to ask questions, and get explicit verbal answers.

But suppose that you could n't speak anything but Polish, and your boss was limited to some form of the English language? Would a danger sign in your language really help you?

Unless it is interpreted, a warning on the outside of the fence is of no use to the man who has to work inside of it.

Safety instruction has to be specific and personal. It has to be talked. It cannot overcome the language barrier. Ignorance of the English language, therefore, is a big obstacle in the way of accident prevention. Printed statements, even in the native tongue of foreign workers, cannot deal with the other causes of error. Only direct conversation and mutual confidence between boss and workers can reveal the real sources of difficulties. The Ludlow Manufacturing Company has estimated that 8 per cent of its infections are due to inability of foreigners to read bulletins and warnings. They have n't been able to learn of the danger of neglected abrasions, and so allow small injuries to go without antiseptic treatment until infection develops.

In a period of eight years the accident records of a large steel company reported by the United States Bureau of Labor Statistics showed a definite connection between lack of knowledge of English and accident hazard. Non-English-speaking workers showed a frequency rate 2.3 times that of American-born (212.6 as against 90.7 cases per 1000) and a severity rate 1.4 times as high as that of the American-born (29.5 as against 21.8 days lost per worker).[1]

A pamphlet issued by the Department of the Interior asserts that, among anthracite miners in Pennsylvania for a period studied, 43 per cent of English-speaking workers had only 28.8 per cent of the fatalities, while 56 per cent non-English-speaking workers carried 71.2 per cent of the fatalities, or nearly double the rate. Even worse was the record of the non-English-speaking in the bituminous mines of Pennsylvania and West Virginia. Had the rate of accidents of the English-speaking in the three districts held good also for the foreign-language workers, there would have been a saving of 716 deaths and 900 very serious injuries.[2]

Records kept in a large steel mill for a period of eight years showed that accidents among non-English-speaking workers were more fre-

[1] U.S. Bureau of Labor Statistics. *Industrial Accidents and Hygiene*, Series 18, Whole No. 234, June, 1918.

[2] *Americanization*, May 1, 1919. Dept. of the Interior, Bureau of Education.

quent and more severe than among those speaking English. Whereas the number of lost-time accidents per 1000 300-day workers among the English-speaking dropped steadily from 140 in 1906 down to 79 in 1913, the rate among those stopped by the language barrier remained almost constant at more than 200 per 1000.[1]

Another plant, a machine-building concern, showed a three-year average of 60.6 accidents per 1000 American-born workers, as against 101.7 among the foreign-born group.[2]

That the higher accident rate among foreign-language workers can be cut down by teaching them to speak English seems to be borne out by the experience of the Ford Motor Company, which reduced accidents 54 per cent during the first five years of the operation of their school.

The teaching of English to foreigners has an additional value owing to the fact that so many of them are illiterate in *any* language. In the ten-year period from 1899 to 1909, when illiterate foreigners were still being admitted by the immigration laws, of all the foreigners who

[1] U.S. Bureau of Labor Statistics, Bulletin 216, August, 1917.
[2] *Ibid.*

came to this country, 54.2 per cent of the south Italians could not read or write their own language; of the Ruthenians, 51 per cent were illiterate; of the Lithuanians, 48.8 per cent; of the Croatians and Slovenes, 36.4 per cent; of the Poles, 35.4 per cent; of the Greeks, 27 per cent, and of the Jews 25 per cent, were totally illiterate in any language. And at the present day, when the importation of illiteracy has been abated, the figures for our foreign-born workers show an appalling amount of total illiteracy. With such ignorance, it is futile even to translate safety bulletins even into foreign languages. The Americanization classes are, for many foreigners, their first schooling in any tongue.

Inexperience. The English language itself is, of course, no guarantee unless it is used. We sometimes make the double error of assuming that a foreigner is stupid because he can't be told, and that an American is "smart" and does n't need to be told. And so, too often, he *is n't* told.

A certain proportion of factories — really not many — give new workmen some printed instructions on safety. Wise little aphorisms may be handed to applicants for jobs to read while they are waiting, or they may be furnished as part of the material in a booklet entitled "Shop Rules." The new employee reads this once to see when or where he can't smoke, and then throws it away. Perhaps the foreman may speak a word on safety as he takes the worker to his machine; but generally he does n't even take the man to the machine.

"Go to work on D-131 over in the corner there," is likely to be the only instruction to the beginner.

And, indeed, safety instruction given the first day is wasted unless it is repeated a good many times. A man may properly plead ignorance of safety until he has been told often enough to know. Just telling him once does n't make him know. Knowing is an act or condition of his mind, not of the teller's. The average new worker's mind is surely no better than that of the college student, and some one has described the latter's brain as being "curiously constructed to resist the intrusion of knowledge." Until we have broken down the new worker's resistance to helpful information, we must consider him an accident risk, on the score of ignorance or inexperience, if on no other.

Inexperience is, indeed, a prolific source of accident. In a textile mill of which I have statistics, two years ago 456 per cent of persons who had served less than one month with the company were injured. And, in another mill, 181 per cent of those employed, on the average less than three months, were injured. This, of course, includes minor ailments causing no lost time, but all of my figures show that the inexperienced man is much more disposed to accidents than the old-timer.

In two mills which furnish me with figures the table of accident frequencies for each length of service group in 1920 shows a gradual reduction of accidents with experience till after twenty to thirty years, when the age factor begins to tell in favor of a higher accident rate.

Startling figures on the rate of accidents per day among new workers were furnished in a report on women in the metal trades.[1] Among press hands the average number injured the

[1] *Employment of Women in the Metal Trades.* S. Doc. No. 645, 61st. Cong., 2nd Sess.

first day was 329. This rate dropped steadily with experience, till after seven months the rate dropped to .47 (less than 1) per day.

Rate of Accidents in Proportion to the Average Number of Employees in Each Length of Service Group

Mill No. 1

Length of Service	No. of Employees	No. of Accidents	Accident Rate
Less than 1 month	41	74	181%
1 to less than 3 mos.	96	121	127
3 " " " 8 "	249	217	87
8 " " " 12 "	183	114	62
Total less than 1 yr.	569	526	92
1 to under 5 years	750	430	57
5 " " 10 "	267	125	47
10 " " 20 "	223	119	53
20 " " 30 "	164	59	36
30 " " 40 "	75	33	44
40 " " 50 "	33	22	67
50 " " 60 "	4	0	0
Mill No. 2			
Less than 1 month	43	61	142
1 to less than 3 mos.	105	159	151
3 " " " 8 "	296	269	91
8 " " " 12 "	325	158	49
Total less than 1 yr.	769	647	84
1 to under 5 years	704	464	66
5 " " 10 "	185	133	72
10 " " 20 "	92	28	30
20 " " 30 "	58	21	36
30 " " 40 "	29	9	31
40 " " 50 "	4	6	150
50 " " 60 "	3	0	0

MENTAL CAUSES OF ACCIDENTS

An unpublished study which was made of the statistics of the Carnegie Steel Company, Youngstown Sheet and Tube Company, International Harvester Company, Fairbanks, Morse, and several other companies, showed that new employees of less than one month's service were six times as liable to injury as those at work over one month. Economy of effort in accident prevention would counsel a concentration of attention upon newcomers. Ignorance due to inexperience is the most prolific mental cause of accidents.

It seems evident that a good part of the accident hazard with beginners is due to nervousness in strange circumstances and distractions from unfamiliar surroundings. This agitation and confusion could somewhat be reduced by a more considerate and friendly introduction than the beginner usually gets, by painstaking explanations and expressions of reassurance and praise by the foreman to give the newcomer confidence, and by the assignment of an instructor to hold the attention of the worker to the job.

THE PUZZLED MIND

Mental limitation. Some men "catch on" quickly, of course — so quickly as to seem scarcely ever to have been beginners. They don't seem to need warnings; or, if warned once, to need no further admonition. But how rare they are! And, in the past, we have rather waited for accident experience in the course of time to reveal just which men were quick to learn and which ones were stupid. Every safety man has thrown up his hands at times at the discovery of workers who seemed unable to profit by experience. Some men will crush their fingers time after time by the same flagrant disregard of rules and of common sense.

An accident in a sawmill in Vermont, which came to my attention, was so perverse as almost to make one glad that it happened. A worker one morning pushed his finger against a saw, which neatly sliced it off. He had the mutilated hand dressed, and with cheerful fortitude returned to work in the afternoon, feeling rather the sensation of the hour. Anxious to get the full publicity out of the accident, he undertook to demonstrate to his fellow workers how it happened. His performance was too realistic and he cut off another finger. He at least had an audience the second time!

Perhaps a normally intelligent person could do such a thing, but it is more likely to happen to a certain type of mind. Some folks have the accident habit. In a Lowell textile mill in 1921, out of 131 people hurt, 29 were injured two or three times, sustaining 69 accidents, and 57 of these were reported as due to "carelessness." They had the accident habit; they learned little from experience.

We may at times have reacted badly and unwisely to such cases. We may simply have lost patience and blamed the worker, when in reality we should have realized that he lacked capacity and understanding. Perhaps the blame was ours, for not having determined his mental powers and assigned him accordingly.

Those who have to do with juvenile reformatories, prisons, and similar institutions find that the vast majority of offenses are committed by "recidivists" (or habitual law-breakers). And of these recidivists a very large proportion are mentally deficient. Indeed, it is taken as *prima facie* evidence of lack of intelligence when a criminal's record shows a history of previous commitments. I am strongly inclined to the belief that, except in cases of workers at extra-hazardous occupations, a history of recurrent accidents should throw doubt upon the intelligence of the victim. I believe that in such cases a mental examination should be held. At all events, accident records should be so kept that repeaters show up in special categories.

Industrial managers are only beginning to discover the full importance of the different levels of intelligence of workers. Professor H. H. Goddard has drawn some analogies between the men who were tested for the draft in the army and the general population. Seventy per cent of the 1,700,000 men who were given psychological tests were assigned a mental age of fourteen years or less, and 45 per cent of them were rated as morons; that is, not capable of complete and independent self-guidance. Professor Goddard feels that this is a good sample of how our general population measures up. Probably it is. The fact that men "get by" on their job, at least, is not evidence of adult intelligence. In a certain silk mill a psychologist who tested three hundred workers found no correlation between intelligence and ability to perform the work well.[1] A great many semi-skilled or unskilled workers who are doing a passable job would rate very low in an intelligence test. It is, of course, fortunate that a great many jobs, also, make no particular call for mental alertness, because this fact gives even dull minds a chance to find assignment in profitable jobs. Textile mills formerly were operated largely by children, so it is easy to believe that the adults who took their places may sometimes possess only childish intelligence, and still do acceptable work.

Accident hazards, however, are not routine. The emergency calls for the keen mind, and comprehension of instruction as to how to prepare for emergencies demands a higher level of intelligence than the normal conduct of the job. Ability to do a job, therefore, is not in itself a guarantee of intelligence sufficient to rate the possessor as a low accident risk.

If you will examine the tests by which the

[1] Arthur S. Otis, *The Selection of Mill Workers by Mental Tests.* Camp Grant, Ill.

different mental ages are determined, you will observe that ideas that will "go across" to a person of one mental age will not be understood by those of a lower age. To illustrate this I have made a tabular abstract of the tests described in Terman's "Measurement of Intelligence."

TABLE I. ABSTRACTS OF A SAMPLE GROUP OF TESTS, SUCH AS ARE USED TO ESTABLISH MENTAL AGES

AGE	TESTS
III.	1. Pointing to parts of the body
	2. Naming familiar objects — shown
	3. Recognizing familiar objects in pictures
	4. Naming own sex
	5. Giving full name
	6. Repeating 6 or 7 syllables (or) *3 digits*
IV.	1. Comparison of length of lines
	2. Discrimination of geometric forms
	3. Counting four pennies
	4. Copying a square (irrespective of size — 4 angles nearly right)
	5. Comprehension of "first degree" — what to do when (Self-taught habits) { sleepy / cold / hungry
	6. Repeating 4 digits (or) 12 to 13 syllables.
V.	1. Comparison of weights
	2. Naming colors
	3. Comparing pretty and ugly, as shown in pictures
	4. Defining meaning of six given common nouns
	5. Game of patience (fitting two triangles together)
	6. Doing three simple things in order named (or) telling age

MENTAL CAUSES OF ACCIDENTS

VI. 1. Distinguishing "right" from "left"
2. Finding omissions in pictures shown
3. Counting 13 pennies
4. Comprehension, of "second degree" — what to do in common emergencies
(Parent-taught habit or judgment): when it is raining; when house is burning; when you miss street car
5. Naming 4 coins shown
6. Repeating 16 – 18 syllables (or) telling forenoon or afternoon

VII. 1. Giving number of fingers (or) naming days of week
2. Description of pictures (things happening — not mere enumeration)
3. Repeating 5 digits (or) repeating 3 digits reversed
4. Tying a bow-knot
5. Pointing out differences, by memory (as between fly and butterfly; stone and egg; wood and glass)
6. Copying a diamond

VIII. 1. Ball and field test (tracing search for ball in circular field)
2. Counting backwards, 20 to 1 (or) naming 6 coins shown
3. Comprehension of "third degree" (action, involving imparted judgment)
4. Pointing out similarities between two things, as between wood and coal; apple and peach; iron and silver; ship and auto
5. Giving definitions by description rather than by statement of for what use (or) writing from dictation
6. Vocabulary — 20 definitions, or indication of knowing 3600 words

IX. 1. Giving the date (day of week, of month, year) (or) name months

2. Arranging 5 weights in relative order
3. Making change (simple subtraction) or count value of stamps
4. Repeating 4 digits reversed
5. Using three words in a sentence (boy, ball, river, work, money, men, desert, rivers, lakes)
6. Finding rhymes (3, for 3 simple words)

X. 1. Vocabulary — 30 definitions (or indication of knowing 5400 words)
2. Detecting absurdities in five given sentences (or) repeating 6 digits
3. Drawing designs from memory (or) construction puzzle
4. Repeating gist of passage imparting information of eight facts
5. Comprehension, of "fourth degree"; (Independent judgment)
6. Naming sixty words (or) repeating 20 – 22 syllables

XII. 1. Vocabulary — 40 definitions — 7200 words
2. Defining abstract words (pity, revenge, envy, justice, etc.)
3. Ball and field test (superior plan)
4. Dissected sentences (rearranging sentences)
5. Interpretation of fables — (giving moral)
6. Repeating 5 digits reversed
7. Interpretation of pictures (imparting ideas)
8. Similarities 3 things — 5 groups of nouns such as snake, cow, sparrow

XIV. 1. Vocabulary — 50 definitions — 9000 words
2. Introduction test; finding a rule after 5 demonstrations
3. Difference between "president" and "king"
4. Problem questions (simple situations to be explained)

5. Arithmetical reasoning (simple mental arithmetic)
6. Reversing hands of clock (or) repeating 7 digits

Average Adult:

1. Vocabulary — 65 definitions — 11,700 words
2. Interpretation of fables
3. Differences between abstract terms { laziness and idleness / evolution and revolution / poverty and misery
4. Problem of enclosed boxes
5. Repeating 6 digits backward (or) 28 syllables
6. Using a code (or) comprehension of physical relations

Superior Adult:

1. Vocabulary — 75 definitions — 13,500 words
2. Binet's paper cutting test
3. Repeating 8 digits
4. Repeating thought of passage
5. Repeating 7 digits reversed
6. Ingenuity test

Even if not many of the tests are clear from this abstract, enough of them are obvious to illustrate that the 45 per cent of workers who are presupposed to be of mental age of twelve years or less would not be able to make some of the responses, or understand some of the ideas which are called for in the last three classifications. Any whose mental age was ten years or less would certainly be accident hazards, in quite the same sense that workers with hernia, cardiac disease, or any other physical defects are hazards.

Getting "home" to slow wits. Apart from the question of positive danger from low intelligence, we need to consider the question of approach to the intellect of the average or less than average quality. While it is true that people in one level of intelligence are absolutely barred from comprehending things that are open to brighter minds, there is a whole range of matters — covering the principal concerns of life and the great bulk of experience — relative to which the differences between different minds is a question of approach. The 70 per cent with a mental age of fourteen are not quite hopeless. In most matters they may be taught, but their interests must be engaged in another fashion. Their senses, rather than their common sense, must be appealed to. The safe and familiar line of thought must be used as a point of departure for new ideas; even prejudices must be taken into account. This is the type of adaptation of means to minds so skillfully displayed by the Hearst newspapers.

For it is the evident and sure result of slow mentality to be lacking in spontaneous interest; to be hard to kindle by abstract appeal. There are fewer interests to lay hold of; fewer ambitions and desires. There is less to tie up with. The type of mind that rocks the boat for amusement, and that "did not know it was loaded," is not easily kept to any one line of thought. The attention wearies easily, and can be engaged more certainly with concrete, moving objects and immediate interests than with the distant and abstract. Pictures, action, drama, the basic appeals of family, sex interests, sports, contest, and class affiliation — these are the fundamental sources of interest.

Recently, I analyzed the amount of space devoted to various subjects in a typical edition of each of the two newspapers of Boston which are credited with having the widest influence with the mass of people. The one which, single-handed, helped to elect the latest Mayor of Boston divided up its non-advertising space somewhat as follows:

Sports	318 column inches
Pictures — cartoons	308 " "

"Home" pages — beauty hints, cooking recipes, and the like 296 column inches
Crime 183 " "
General news 162 " "
Including
51 inches of sex discussion
53 " on accidents, and only
18 " each on what I considered "legitimate news" and on business
5½ " on foreign affairs, and
5 " on educational matters.
Politics, including a good part of political scandal took up 144 inches; drama and movies, 107 inches; editorial matter, mainly discussing the crime and scandal detailed in the news columns, 64 inches.

It will be seen that not alone are the serious interests given very slight attention, but that the remainder of the space is very shrewdly disposed to catch the most wayward attention.

The other influential paper had much the same arrangement, with the exception of the fact that, inasmuch as it appeals a great deal to race hatreds and foreign prejudices, it is edited for those who do not easily read English, and it gave 551 inches of space to pictures.

Personally, I do not feel that the mere appeal to widespread interest is in itself wicked. Any harm in adapting the appeal to the interests of the audience lies in the action stimulated. Those who wish to stimulate improvements in public manners, habits, and morals not alone have to compete with the shrewdest mobilizers of public feeling, but even must do so by appealing to the same interests, if they intend to succeed.

The adaptation of safety instruction to the interests and attention-span of ordinary minds is well suggested in some rules for safety bulletins offered in Bulletin 77 of the New York State Department of Labor, on "Industrial Accident Prevention." It advises, with regard to

Brevity — that the shorter it is the better.
News interest — that it be kept fresh.
Statistics — that they be shown by charts, rather than by figures.
Content — that pictures be preferred to print.
Style — that it be humorous, cartoons being preferred to solemn diagrams.

And it might have gone on profitably to advise that the personal interest — items about people — be preferred to ideas about things. The

Bulletins of the National Safety Council admirably conform to these canons, but it is helpful to consider the means by which they secure their effects, in order that local efforts can make sure to follow the same principles.

The Cleveland public schools have put safety into the curriculum, and with a splendid knowledge of pedagogy, based upon a comprehension of the learning powers of children at different mental ages, some one has devised procedure for teaching safety to children progressively in the different grades. His plan might well be extended to adults. For the things that are given to very young children are the things that may properly be most emphasized for the largest number of adults. The things that are reserved for the older children must be reserved for a smaller number of adults.

The first thing in the right curriculum of any school of safety is to habituate workers to the signs of danger that come to them directly through the senses; the eyes, the ears, the touch, the manual habits, etc., because the most universal comprehension comes through the senses. It is instinctive to dodge objects which we see moving toward us, to jump at strange noises, to draw away from harsh, cold, or hot objects coming in contact with the touch. And yet, these instincts vary with different people, and the promptness with which they evidence themselves can somewhat be cultivated. Certainly, safety men should strive to simplify the appeal to the senses, using broad effects of color sharply defined, large type lettering, and easily differentiated warning bells.

The next most difficult thing to comprehend and learn is what might be called "static safety," which consists simply in knowing what are dangerous places and dangerous machines.

For instance, emery wheels and belts may have hidden defects causing them at any moment, without warning, to fly apart, striking any casual passer-by. But the line of travel of flying parts can be accurately mapped and workers can be taught where it is dangerous to stand. In weaving, shuttles fly out of looms at nearly predictable intervals with something of the force of a projectile, and eyes may be put out or bones broken by these accidents. But the line of travel of flying shuttles can nearly be mapped and workers can be taught where it is dangerous to stand. Crane-ways can be marked and workers made to feel that it is dangerous to stand in the possible path of swinging loads of molten metal and heavy materials. When the rules against piling obstructions in aisles are enforced, and aisles are clearly marked, workers can be taught to walk between the painted lines.

Such knowledge can be ingrained in the lowest intelligence, in animals, even, and may serve to keep many out of the way of danger. The information may need to be conveyed by discipline, by suggestion, by dramatic methods, by anything rather than simple verbal warnings, but the nature of the information is comprehensible to any intellect.

Next comes knowledge of safety in ordinary activities, and consists in knowing what are dangerous movements or dangerous phases of processes. Static safety deals with things that remain constant, but this phase of safety deals with things which change from time to time, but which, nevertheless, recur regularly. People of moderate intelligence can be taught to react habitually to such conditions.

The time of starting up a machine which has been stopped for repairs or for new work is a dangerous time because some other unsuspecting person may have his hands on working parts. Belts or pulleys, temporarily unguarded, carelessly piled materials, unguarded gears and rolls, moving elevators, projecting nails, and slippery floors, are all conditions which workmen can be taught to recognize and react to. Women may be drilled to know that it is unsafe to have their hair unprotected around moving belts, or to wear loose garments which may catch in the machinery. They may even be made to feel that it is unwise to wear high-heeled shoes at work. All of these recognitions are associated in the mind with conditions, temporary situations, and the like, which do require a bit more judgment and discrimination than a mere knowledge of dangerous places, but they lie wholly within the sphere of the discipline of average intelligence.

Next, and rather high in the scale of knowledge, comes training in acting safely in extraordinary conditions; unforeseeable circumstances where dangerous conditions develop suddenly and without warning, and where prompt and effective judgment must be exercised to save the lives, sometimes, of many people. I remember the story of the soldier in a dug-out, with many other soldiers, who was inspecting his hand grenades before going out on duty and who accidentally pulled the pin of a grenade. Knowing that a tragedy was unavoidable, and merely concerned with seeing that his own accident should not become a general disaster, he hugged this menacing bomb to his stomach, threw himself down in the corner with it, his back to the crowd, and so got most of the effect of the explosion himself. He died gloriously, and the others were saved.

But there is one state of intelligence higher even than this good judgment and it can be cultivated only in a few. It is the imaginative state which foresees almost all possibilities of danger and forestalls them. It is not possible to drill the great mass of workers in this faculty, but those who do evidence such capacity can be made, in a way, the custodians of the safety of less high-geared minds. Every such imaginative person enlisted on a safety committee is a great asset.

The aim in safety education should be to adapt it to the varying degrees of intelligence in the factory. Obviously, some ideas are more fundamental than others. The things which it is necessary to know about accident prevention can be classified in as many ways as the presumed or tested intelligence of the workers is grouped.

1. Ideas of safety which every workman must get, foreign- as well as English-speaking, mentally deficient as well as highly intelligent, young as well as mature.
2. Ideas of safety involving memory and obedience to simple instructions.
3. Ideas of safety involving application of experience to new situations — judgment.
4. Ideas of safety involving imagination, ethics, and moral character.

When the material to be taught has been so classified, the manner of "putting it over" should be worked out so that each class of material is adapted to the corresponding grade of intelligence required. The "greatest common denominator" for each intelligence group — that is, the type of appeal which will hit the greatest number of them — should be preferred. For instance, the imparting of the most necessary and general group of ideas should be largely by means of pictures, bright colors, and simple language. Whenever possible, habit-training should take the place even of this instruction.

On the other hand, instruction in the fourth group of ideas can largely dispense with pictures and the familiar simplicities of safety, and with more success can be imparted by means that, in the very act of learning, require employment of the imagination, discrimination in ethical feeling, and exercise of moral character. The discussions of shop committees represent the acme of such education.

CHAPTER III

THE MISGUIDED MIND

The physical examination, of course, would not be so common in industry to-day, were it not for the Workmen's Compensation Acts. Employers feel that if they are going to be forced to pay out money to compensate operatives who get hurt, no matter who is to blame, the least they should do for self-protection is to engage only those who are physically sound. Obviously, a man suffering from hernia would be a "bad risk" on a heavy lifting job. And a case of cardiac disease should preclude an applicant from attempting to run an elevator. Physical examinations, therefore, are instituted to exclude those who would be most liable to injury.

In general, however, employers are not getting the full worth of their money from these examinations. This primary purpose is not being served as well as it might be. The deficiency is not that the medical men engaged for industrial work are poorly equipped, but that they have not specified, and made tests for, the appropriate physical requirements of mechanical jobs. Until the Workmen's Compensation Acts secured them assignments in factories, their experience with physical tests, on a scale large enough to develop a technique, had been gained in just two fields: insurance and the army. The types of examination which grew up in these fields had, in each case, a special purpose in view; the insurance routine was designed to exclude applicants found suffering from functional diseases, and the military examination aimed to sift out rookies who would prove unfit for campaigning.

The industrial examination is an outgrowth of those two procedures. They had, in neither case, pointed to the disclosure of any special accident liability; therefore, the industrial routine has failed to do so. An exception, of course, might be cited in the case of railroad workers, examined for color sense, for ability to hear a watch tick, and, perhaps, for other minor faculties. But even the railroad examinations had in view only the selection of men who could comprehend signals well enough to avoid wrecking trains. There was no effective idea of preserving employees from injuring themselves.

With the routine of the insurance doctor before them, therefore, and such forms as they could get from the Surgeon General of the army, and from company physicians in the railroad claim departments, the early industrial physicians sat down and devised an examination blank. Their inspired product of a decade ago is used, with sterile uniformity, in most factories to-day. They have advanced little since, and, so far as they have gone, it has been chiefly in the direction of medical diagnosis, rather than in the direction of appraising the workmen's native equipment. From time to time they have added Wasserman tests, laboratory tests for hookworm (in Southern mills), medical history, and other items. The recent experience of many of the doctors in the army has spruced up the examination form a bit; it has caused some to add a few more items, such as, "endocrine system." The terminology is a little more standard.

Little by little, too, the experienced workers in the plant hospitals have learned from the accident records what are some of the most definite compensation hazards. This, however, is not precisely the same thing as discovering the predisposing *accident* hazards. For instance, a man blind in one eye is a special compensation risk, because, if he should happen to lose the other eye, the company would have to pay for total blindness. A man with one eye defective, however, is also an accident hazard. If he lacks stereoscopic vision, he cannot accurately judge distances. If he is nearsighted or otherwise deficient in focus, he may stumble into an accident. Clearly it is just as important to consider this type of impairment as gross injuries. But they are not so patent. It is easy to know the direct compensation risks; they show up on the records. It requires much more study, and, oftentimes, a knowledge of particular jobs, to appreciate the more subtle accident hazards. Hernias, bad hearts, positive tuberculosis indications, missing organs and members, and epilepsy (where it can be detected) are evident risks. And the physician has not been urged to inquire beyond such possible troubles and look for more obscure ailments.

It is surprising, however, that so little attention has been given to sense defects, which, while they have a less obvious bearing on compensation, exert a very positive influence on accidents. Even physicians, perhaps, continue to think of us as having only five senses. Almost every layman, of course, would say that hearing, seeing, smelling, tasting, and feeling complete the list of the special senses; and yet, one dictionary will tell you that we have seven, and another will enumerate twelve, senses. Probably the list will grow longer in the course of time, but twelve senses are enough for the average plant physician to catch up on. At present he inquires into but two of them — hearing and seeing — and usually stops far short of adequate tests for these two.

This neglect of the physicians is chargeable in part to the factory executive. No profession advances far except in response to lay criticism, and the work of the industrial doctor has n't been critically appraised. Nor has he been entirely assimilated into the organization line-up. His part-time status and his professional exclusiveness have puzzled the industrial executive. Instead of reshaping the individualism of the doctor, the manager has allowed him to remain outside of the picture. The medical examiner has not been asked to study the physical requirements of jobs. His tests for fitness have not been questioned. If he wanted to stop with feeble observations of eyesight and hearing, all very well. No one knew any more than he, on these matters. The rôle of the other senses in personal efficiency, certainly, is not commonly appreciated. Only specialists in psychology realize how greatly any defects in the conscious faculties impair the scope of the intelligence. The average person seems to feel that the mind can operate independently of its environment. The fact that faulty information received through our senses, and, especially, that failure of our senses to furnish us with a full line of information, cramps our minds, is not generally given a thought.

We have no communication with the outside world, however, save through the senses. Our ideas are all cast in the form of our sensations;

our memory is a persistent record of visual and other impressions received from the senses. The nervous system, with its end-organs, its inherited modes of response, and its gradually fixed condition resulting from accumulated experiences throughout life, is at once all that we possess as minds and as a means of knowing our environment and our bodies. The nervous system, including the senses, is a means and a manner which parts of our body have of reacting to actual physical contacts with each other and with the outer environment. As we walk about or sit at our desks, we feel reasonably free of personal contacts, but we have much more touching us than our clothes. The hypothetical ether, the air, and many particles of solid matter flow around us, as water flows around fish in the ocean. Some elusive fluid medium is always about us. We cannot for one second push them all away, nor keep them still. If one is not present, another rushes in to take its place. We are aware of our environment, at all, only through its reaching out and touching us directly, or by its setting up currents in the surrounding stream.

And what marvelous varieties of impressions the contact with reality makes upon our responsive bodies! What waves of color penetrate our eyeballs! What mazy whirls and undulations in the air roll in to meet the delicate ear drum and set it into vibration in sympathy with notes of music, the cries of the street, or the crash of thunder! And when we walk into the garden we are made aware of its blooms, not only by the vibration of color sent through the ether, but also by airy clouds of solid particles of matter that enter our nostrils, to make us conscious of their odors. Sight, hearing, and smell, all, are nerve responses to invisible but very real tactual stimulations. Something unseen makes an impact upon our very bodies, in each case. It is as if we were bombarded with pure energy.

These impressions of the apparently remote stimuli come and go; they compel attention by their endless variety. Somewhat less keen is the sensation and awareness we get from actual physical proximities with solid matter — the sense of taste, and the various senses of touch — heat, cold, pressure, and pain. (There are at least nine subdivisions of touch). The first onset of such contacts — such as the bursting of a grape upon the tongue, the touch of a warm hand, the tingle of an electric battery — may be more thrilling than any mere visual impression, but there is less play and variety in such contacts. They are likely to be sustained through intervals of time, and, when they are long-continued, sensibility gradually fades out. Otherwise we should not be able to sit for hours at a table, reading. If the mind remained acutely conscious of every curve of the chair, of the garments that cover our limbs, of the floor under our feet, we should be too agitated to think.

And there are other senses of which we are still less conscious — a group of internal sensations flowing from the adjustment and movements of the parts of the organism relative to each other. The semicircular canals in the ear have in themselves the faculty of recording the variations of the force of gravity upon the body, and thus enabling us to keep our balance. The arteries, the muscles, perhaps other tissues, record relative position, through nerves that inform us, even in the dark, where our various members are, and permit us to direct them as we please. The precision with which a billiardist strikes the cue ball, for instance, or with which a telephone operator inserts the right terminal plug into the right hole in the switchboard, is gained by the internal sense of the relative position of the muscles. Even the rhythmic functioning of the body, the breathing, the pulse, the blood pressure, is recorded in our sensations, although but slightly in our consciousness. Speech, too, is a product of nerve controls. We are able to stretch or relax the vocal cords and to vary the air pressure upon them as the result of habits, guided by and growing out of the internal sensations which accompanied accidental variations in these movements in the past. Even the abstract conceptions of time and space are but relative measurements of internal sensations.

Not for the mere purpose of seeing, hearing, and feeling, of course, are we given this marvelous equipment of senses. Pleasure, æsthetic emotions and ideas are their own excuse for being, it is true, but they are, after all, the mere accompaniments or developments of more immediate uses of the nervous organism. The high development of our nervous equipment is a product of evolution, and the result of useful employment of the senses in the struggle for existence. Some senses are less acute in man than commonly in other animals, because less employed, and others are more delicate. Man's nose is duller, his eye in general more keen. The field of vision surveyed jointly by both of man's eyes is ninety degrees. In animals it is much less — a little over one third in a rabbit, and only five degrees in a carp. This lowers the comparative visual efficiency of an animal, which must rely more upon the nose, or upon other organs, to gauge the position of objects. This may offer partially the reason why man's sense of smell is so much less acute; he does not need it. It is rather in the obscure senses, or sense relationships, the work-a-day faculties of rhythm, position sense, balance, and all of the variants of touch, that man's capacity for skilled employment lies. And in these, quite as much as in the faculties of seeing and hearing, inheres his ability to avoid the awkward movements that result in accidents.

If one man's endowment in these matters were the same as another's, we could well afford to take them for granted and ignore them, as now we do in our physical tests. But the natural sense acuities of different individuals vary so widely that, by tests, we can determine in advance whether one will have better success than another in certain lines of activity. We know from experience that jobs differ ever so slightly in the call they make upon strength and intelligence; will bring some workers to grief, while offering the opportunity for others of no greater merit to succeed. Such anomalies result from fundamental but concealed differences in the sense equipment of different individuals. The studies which Münsterberg made years ago in the selection of telephone operators, ship-workers, motormen, and office-workers aimed to bring to light the hidden sense variations which had a relation to efficiency in each operation. In studying clerical operations, he found that girls who were most rapid and accurate at sorting frequently were useless on the calculating machine. They might press the wrong keys or make errors in copying the totals. In light mechanical work, some women could be trained accurately to grasp, in one movement, a dozen pencils — no more, no less. Others who failed at this proved efficient at the still more exacting task of applying gold leaf to pencils before stamping. Dr. Henry C. Link, in tests to assign girls to work as gaugers and inspectors, found that, although estimates had considered the two types of work as very similar, nearly all of the gaugers were girls who had first tried inspection and had failed. On closer study he found there was a difference in the sense requirements.

When these casual investigations reveal such differences, it becomes clear that a more general and comprehensive study of the sense requirements of jobs, and of the relative endowments of applicants in respect to the particular senses important in each case, would yield striking results. As no such broad study has been made in industry, this is a mere confident speculation. But I feel sure that experiments in this line would point clearly to the value of supplementing the standardized medical examination with a special physical test — for strength, endurance, and sense equipment, varied according to type of work. The advisability of such special fitting of men to jobs as a measure of increased production efficiency seems clear.

The necessity of such adaptations in preventing accidents is still more clear. It has long been recognized by safety engineers that some men were "temperamentally unsuited" to certain jobs. Some are "slow," dull, laggard — apparently too clumsy for rapid-fire, exacting work. But there has been little thought of determining by test the relative natural speed of workmen. Just what the individual's natural speed is can be determined by test with apparatus which takes a man's "reaction times."

In this test, the subject is seated at a table with his finger on a telegraph key. At a signal, he is required to press, and then release, the key. Although the reaction appears instantaneous, there proves to be always a measurable interval of time between the giving of the signal and the pressure on the key. This interval is the record of a vital human experience — the epitome of all our responses. A flash of color waves, or an eddy of sound, has traveled from the signal to the eye or ear of the subject, stimulated his brain, sent an order down through the nerves of his arm, and caused him to press the key. And the time which has elapsed proves to have varied with the subject; one man gets and acts on the idea quickly, the other slowly. When the signal was flashed, by the same motion an electric current was set up, and a pointer on a dial began to mark off fractions of a minute. When the telegraph key was pressed, the electric circuit was, by that same motion, broken and the pointer was stopped. The pointer moved on the dial, therefore, only while the subject was getting and acting on an idea, and the time interval traced on the dial is the subject's "reaction time" to that particular stimulus. He will have different times for different stimuli. There will prove to be one reaction time for hot, another for cold, one for touch, and still others for sight and sound.

In any given individual these times vary according to his capacity for attention, as well as according to his physical equipment. In childhood and in old age they will be slower. The difference between individuals is recognized by astronomers, who make allowance for and check against the "personal equation," in order to assure the accuracy of celestial observations.

Reaction times also vary according to the strength of the stimulus. A loud noise or a bright light will produce a reaction approximately twice as rapid as a faint signal. Partially deaf people, or those with defective vision, therefore, would not respond as rapidly, even to a plainly perceived stimulus, as those who received a livelier impression. Partial deafness or weak eyesight obviously diminishes a worker's response to danger signals.

The quickest reaction is obtained when some warning signal precedes the exhibition of the agreed-upon stimulus, by an interval. But the necessity of stopping to recognize and discriminate between signals, or of choosing between types of reaction to them, lengthens the time. An emotional association prolongs it greatly.

So we see that the intelligence and mental balance of an operative also have a good deal to do with his "pep" in responding to changes in his surroundings.

Closely akin to reaction times is the matter of rhythm. "Every person," says Professor C. S. Myers,[1] "has his own best rate of repetition of movement, a rhythm peculiar to himself." The exact source of rhythm is not established; but it is clearly an illusion of the senses, corresponding to some internal adjustments.[2] The keenness of perception fluctuates regularly in intervals that vary for different individuals, so that, while the stimulus responded to may be constant, the responses belie the fact. If a metronome (such as music students use to keep time by) be set going, or any other regularly recurring beat sounded, a test subject listening will hear the beats in groups of two, three, or four, and believe that the first beat of each group is accented. As the rapidity of the beat is altered, the apparent grouping changes. At

[1] *Mind and Work*. New York, 1921.

[2] James Burt Miner. "Motor Visual and Applied Rhythms." *Psychological Review Supplement*, vol. 5, No. 4.

the same speed of the metronome, different persons will form them mentally into different groups.

And not only does the subject hear rhythmically, but, without knowing it, he reacts rhythmically. Thus, it is possible in the laboratory to set up apparatus that records the unseen and unsuspected alternate tensing and relaxing of muscles which appear to be still. And while the recurring signals are being sounded with unvaried regularity, the motionless subject will record his rhythmic arrangements and accentings of these signals, in groups of two, three, or four. This is his particular rhythm.

When sounds or sights are recurring rhythmically, as in the regular accenting of the first notes of musical measures, the mind tends to form temporary habits of anticipating these beats by its own perception rhythms. It is obvious that some such accommodations are difficult and others easy. It is common experience that some rhythms are pleasing and others too slow or too fast for steady attention. People differ, too, on this. Some are slow-moving, some quick and "snappy." Others have no sense of rhythm at all. They are the poor dancers, the people who abhor "jazz." They cannot even be taught. The best music schools nowadays, I am told, test the rhythmic sense of would-be students and reject those who are unable, as the expression goes, to "keep time."

It has been said that a slight rhythmic disturbance, incessantly repeated, would cause a tower to fall, because it has a normal sway or rhythm of its own to attend to. Certainly factory operatives tire when they must respond continually to machine rhythms not agreeable to them. And, on the other hand, natural rhythms help them to perform their work with less weariness. Cigar-makers in Havana tobacco factories employ singers to entertain them at their work, and it is well known that negro cotton pickers or dock workers labor more willingly while singing; that band music relieves the fagged soldiers on the march; and that the sailor's chanty helps to haul in the cables.

It is quite likely, therefore, that there is an accident hazard in putting an operative, whose sense of rhythm is too slow or too unstable, on a dangerous machine with regular beat, such as a punch press. If he get out of time with the machine, he will put his finger under the die, and leave it there. A marine engine tender in turning the cap of an oil cup has to insert his arm in and out between the giant strokes of the piston once every revolution. Just what would happen if his sense of rhythm were deficient, I cannot say, but I have watched many times, in the expectation of seeing him insert his arm at the wrong time.

Even the little considered sense of balance plays its part in preserving the workman from accident. The personal variation in this faculty is not usually large and yet some people are more easily made ill by car-sickness or sea-sickness, or by riding on a merry-go-round, than others. Some become thoroughly unsettled by finding themselves on high places. Whereas Blondin, the tight-rope walker, successfully crossed Niagara Falls on a stretched wire, the average person cannot walk ten feet on a railroad rail. In selecting aviators, the Government thought it worth while to test applicants for balance by means of the well-known whirling chair.

So it comes that there is a certain cruelty in assigning persons with defective semicircular canals to work at heights or where the footing is insecure. Every skyscraper costs one or more lives by falls from the skeleton structure under construction. Many a maintenance man in factories falls from stepladders, scaffolds, or ledges, because he too easily loses his balance.

A quite different type of danger grows out of an inaccurate feeling of muscular movement — defective position sense. Fancy the exactitude required by operatives at a circular saw which cuts ivory nuts up into pieces suitable for buttons! The worker is on piece-work, and with lightning-like rapidity he pushes the many-shaped nuts up to the saw. His fingers come ever so close — if but a fraction of an inch closer, they will be snipped off. The same accuracy is required by a sewing-machine operative on men's clothing, when he fairly rips a seam under the needle. A pierced thumb will be the penalty of a faulty move.

Earlier in this chapter I spoke of feeble eye tests. The tests are feeble — they do not always show up feeble vision. For instance, they usually stop at determining an applicant's ability to read types at a fixed distance. But even separate tests for each eye do not always show up defective stereoscopic vision. The latter faculty is not a separate sense, but a relationship between the somewhat different images formed by the two separate eyes. It is what enables us to judge of the relative nearness of objects. A victim of "squint," an optical habit, in which one eye lazily gives up looking, or a person whose eyes do not focus together, will see images in two dimensions, instead of in three. The person suffering from either of these impairments will be forced to estimate the relative distance of objects by comparing their apparent sizes, or their color intensity. But these are not safe guides. A boxer who gets an eye closed must soon go down or quit the ring because he can no longer tell where his opponent's blows are. We may suppose that many a repairman puts his fingers into the gears because his eyes do not accurately record distance.

We have two ears for the same reason that we have two eyes — to get separate impressions, for purposes of comparison. We locate the direction of a sound right or left, front or back, by an unconscious weighting of the intensities of the sounds separately received, and by measuring the interval of time between the sounds received, first in the nearer ear, and then in the farther one. The submarine detector developed in the war used two sound receivers in just the same way, recording on a dial the time interval between the two vibrations. If one receiver were out of business, the whole apparatus was useless for pointing directions. So with the bi-aural sense. It depends upon two good ears, and it has a value in dangerous operations in enabling workmen to judge the source of noises.

Need we say more? The need of a good equipment of senses is abundantly clear, when we consider the workman in dangerous trades. His senses are his safety messengers, his Intelligence Department, which tells him where the enemy is concealed. If he cannot trust his eyes, if he cannot believe his ears, if he cannot be confident of his own movements, his is a misguided mind, and he should not be forced to risk his life in contact with machinery. In entering upon his duties, therefore, he is entitled to a rating in the particular physical requirements of his assignment.

CHAPTER IV

THE STUBBORN MIND

Attitudes that resist the Safety Gospel. When the pioneers in the safety movement took up their task, they had to begin by attacking a fundamental trait of American character—cheerful recklessness. The apparent aim, to study and provide safe operating conditions, was, in itself, a big enough problem. It was not easy to discover what was safe practice. It was, however, a still harder matter to make people *want* safe working conditions. The average American is disposed to take chances. He does not always consciously intend to do so, but his nature is headstrong. He may even openly and honestly assent to "Safety First" preaching, serve on committees, or even sometimes direct such work as a safety engineer, while himself an inbred dare-devil. From the earliest childhood, the American boy is taught to do the risky thing. He skates on the first thin ice of winter, being the more gleeful about it because it *is* thin ice. In the summer he takes high dives into shallow water, attempts to climb the highest tree, and, while playing circus, attempts impossible stunts to thrill his onlookers. He goes to the movies and sees Douglas Fairbanks walk the peak of the roof, barefooted, bearing a lady in his arms, or, with his single trusty blade, dispose of nine cutthroats at a slash; and the young hopeful is minded to do like deeds of derring-do. He sees photographs in the Sunday papers of airmen jumping from one plane to another, thousands of feet above the ground, and then goes out and tries his little darnedest to duplicate the spirit of the stunt. A few years later, when he learns to drive a motor car, his measure of achievement is the speedometer. He thinks it particularly skillful, moreover, to be able to drive with only one hand on the wheel. As he grows older, he drinks and engages in other risky pastimes, quite as much in a spirit of daring as in response to wayward prompting. "Steve Brodie took a chance" is one of his mottoes. And another is, "I will try anything once, and, if I like it, I will try it again."

This philosophy soon becomes second nature, and when a war comes, we praise the results it produces in the courage, ardor, and light-heartedness of our soldiers. We proclaim it abroad as American grit. We immortalize it as the Spirit of the Argonne. Then we bring our young men together in factories and begin telling them — "Don't get hurt" — "Take care of your hide" — "Think safety" — and expect them to do so because we have put up a sign!

Is it surprising that men who attend melting furnaces in factories have to be watched steadily to persuade them to wear goggles to protect their eyes from splashes of hot metal? Is it to be wondered at that window cleaners, perched high up on the outside of a building, neglect to attach their safety belts to the hooks on the window frames, when tremulous crowds applaud their reckless courage? Indeed, do I not myself prefer to drive my car over icy roads without skid chains, because I take a certain pride in my ability to bring the bus around after it starts to skid?

No; we are up against a much more difficult task than we suppose in attempting to get men to walk in the ways of safety. They may want to be good fellows and to act cautiously, but their minds are bent in the wrong way. It takes some pretty fundamental training to counteract the inherent tendency of the American to take chances. Horrible examples alone won't do it. Very few men can be scared into keeping their fingers out of the buzz saw. The remedy for faulty ideas lies in a somewhat different direction, as we shall presently see.

Many men who are reckless in their behavior are neither braggarts nor excitable chance-takers; they are merely fatalists. The majority of men believe that they are foreordained to die on a certain day, and that till then the Lord will protect them up to the very hour. "I figure, if your time has come, you are bound to go, whatever you do," they will say. And the implication and belief are that one may flirt with death with impunity up to that time. Reënforcing this fatalistic belief is the experience every one has had with "close calls" which resulted in no damage. I once saw a Ford car, in which seven men were riding, caught between two street cars and smashed so completely that the body of the car was later cast upon the side of the street, a mere pile of junk; and none of the men was seriously hurt. It seemed miraculous. Indeed, it was miraculous; and, doubtless, in the minds of those who escaped the view was impressed that accidents, if they occur at all, are "sent on you" by Providence, whether you exercise precaution or not.

Many who feel that the cause of accidents lies outside of themselves modify their fatalism by belief in a Providence that may be propitiated. In their faith, misfortune is n't exactly foreordained; it may be done up in a package with your name and address on it, but it may not actually be sent to you. If you avoid walking under a ladder, or have a care not to break a looking-glass, and manage to look at a new moon only over the right shoulder, you will escape bad luck. Few men and women admit superstitions, but fewer still will flout them. This is really significant. It represents a vast influence in the unconscious mind of the people, a common inheritance of religious beliefs embedded in the race since savage times. It is even taken over as a respectable element of more recent religions, most of whom, by their prayers, admit a belief in a Special Providence that looks after small concerns of individuals.

The number of men who wear charms, rabbit's feet, relics or talismans over which a blessing has been spoken, or carry lucky coins, is undoubtedly greater than all the men who practice Safety First. Sailors and soldiers carry mascots with them as some sort of added protection in battle. In popular legend, the number of enemy bullets that have been stopped, just short of piercing a brave heart, by the Providential interposition of a pocket Testament or a sweetheart's picture surely equals the total number of fatalities!

These superstitions are important as a factor in creating indifference to, or skepticism about, safe practices. They lie at the root of the dangerous fallacy that all accidents are accidental. They are responsible for most of the inertia which safety men encounter when they first attempt to interest a group of employees in measures of self-protection.

Inertia is not always frankly related to fatalism. Oftentimes it takes the offensive and resists safe practices as an infringement upon a man's natural rights. Many resent innovations or consider such rules as those requiring them to wear goggles as a reflection upon their intelligence. Such reactions would hardly be felt, however, if there were not more reliance upon predestination than upon precaution.

In such attitudes as we have mentioned — bravado, fatalism, or resentful inertia — we see exhibited in workmen "mental sets," tendencies that predispose them to accidents. These attitudes exist before the safety gospel is preached, and often remain firmly rooted and actively opposed to safety after the stubborn mind has appeared to give assent to the gospel.

And there are other ideas which stand in the way of safety which ought to be mentioned in passing — especially fear of doctors. When infections occur through neglect of wounds, or from failure to go to the hospital for treatment of slight abrasions, in many cases it may be due to the distrust of the medical department.

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Poorly trained or undeveloped people have an instinctive and often quite unreasonable fear of hospitals, and of surgeons, nurses, and dentists. They have an inordinate faith in the antiseptic value of glue, shellac, chewing tobacco, gasoline, and the like, but an almost superstitious fear of knives, bandages, ether, and even the white cleanliness of a hospital. Many ignorant people feel that to go to the hospital for an operation is equivalent to a death sentence, and they take it for granted that bearded surgeons in white aprons take positive enjoyment in cutting into human flesh. Even a nurse must be excessively feminine, gentle, and ingratiating to counteract the presumption in many minds that the doctor's assistant is only slightly less bloodthirsty than he is. It needs all of the human wiles on the part of the medical department and its good friend, the service manager, to sell the idea to workers that it is a kindly and helpful department, bent upon reducing pain instead of on inflicting it. We have all, perhaps, seen the cartoon of the little boy with the swollen jaw writing under the sign of the so-called Painless

Dentist the vindictive word "liar." We must take care that workers do not write, under the sign of the first-aid hospital, a similar comment.

To account for the weird attitude of many workers toward medical departments, we have to acknowledge two very reasonable explanations. In the first place, the attitude of medical people in this country was formerly not all it should be, particularly toward indigent patients in free clinics. The careless practice of medical students in dealing with lifeless subjects in the dissecting-room sometimes carried over in the treatment accorded penniless victims of disease. And a prominent physician of my acquaintance, discussing this point with me, says that, in European hospitals, with which the majority of our workers got their early experience, the attitude is still as callous as it formerly was here. One famous surgeon in Leipsic, who was taking my friend through a medical school, said that, from the point of view of instructing students at a clinic, it was preferable to have the subject, even a woman, enter the amphitheater entirely nude. To the doctors, probably, there was no violence in this idea, but upon a woman of any sensibility at all such an experience would produce a shock, and leave a deeply embedded memory. The sight of a doctor, henceforward, would always call it up, with a feeling of disgust.

Furthermore, we all know what a great lore of pseudo-medical knowledge exists in the minds of simple people. Grandmother's home remedies, consisting of herb tea, mustard plasters, and what not, are all intermingled in their faith with superstitious rites closely related to the voodoo practices of the negroes. Many untrained people rely upon traditional medical treatment with more confidence than upon doctors, who have, for reasons already stated, so many forbidding associations attached to them.

It is clear that, when such prejudice against doctors exists, there is a mental resistance to the rule that workers should go at once to the medical department for a dressing of even the slightest scratch, to avoid infection.

Different workers have different mental quirks. One man may subconsciously resist safety instructions because he is a sullen radical, and wishes to believe nothing told him by capitalistic employers. Another may have an unnatural timidity, and fears to ask his foreman for instructions which he needs to avoid accident. Many are inordinately given to horseplay, and through sheer devilment, but without wicked intention, inclined to play dangerous tricks upon their fellow workers. Any of these and many other ideas or bents are positive predispositions to accident and must be dealt with and cleared away before the ordinary routine of accident prevention can have a chance.

The chief mental resistance to good safety ideas — aside from recklessness — comes from so-called chronic kickers. They are the skeptics, grouchers, "ice-men" — however they may be nicknamed — which we find in every organization. Whether their obstructionism merely takes the shape of objecting to new things and ideas, which is a form of laziness growing out of the middle-age instinct to protect our habits from disturbance; or whether it takes the form of positive ill-will, such as taking new proposals as grievances, involving threats of strikes, demands by walking delegates, or breaches of discipline and sabotage — the protest of the chronic kicker is an expression of an "attitude" which helps to bar the way to a programme of action for safety. The chronic kicker is a plague spot in any department, a source of evil contagion. He must either be won over, transferred to some isolated post, or discharged. It is rare that a cause can succeed fully in spite of the knocker; usually it is an uphill fight until his fellow workers have been led to deal with him or he is nullified by one of the courses suggested.

Clearing the ground for ideas of safety. With such cases in mind, it is easy to understand how much there is in the programme of safety which consists in removing ideas already in existence. Few of us have the patience to do this consistently. Sometimes we despair because arguments do not move people to do what we wish. *We* have confidence in the arguments. We have even seen them work successfully in other cases, and we wonder and are annoyed when we strike cases that are not amenable to arguments. "For the love of

Mike, Mutt, listen to reason," begs Jeff; and if we understand human psychology, we shall have more hope of Mutt's changing his course "for the love of Mike" than as a result of any trust in reasoning. Emotions and prejudices, preëxisting ideas, all the lumber and clutter which years of emotional experience have accumulated in our minds, have far more influence over what we are persuaded to do than anything we come at, or anything that is put to us, in terms of logic. The average person first decides what he wants to do as the result of his feelings and desires, and then justifies himself by inventing reasons which, he pretends, govern his actions.

What determines, then, what a man *wants* to do and believe? If something irrational stands in the way of his making an open-minded approach to truth, what is the force of that something? Clearly, there is an emotional element in it, because men feel strongly about their convictions. Contemplate two Grand Army men in an Old Soldiers' Home, engaged in an argument on some trivial point. They flourish their canes in violent temper. Two country loafers in a village store squabbling over politics — matters in Washington quite out of the field of their personal interests — evidence a degree of feeling which they are not likely to experience in a domestic crisis in their own family. They are engaged in argument, in each case, not for the purpose of submitting their views to the test of reason — they do not consider the possibility of altering their own positions, nor so much hope to convince their opponents as to show them up. The impelling force to get into the argument at all is emotional; they feel that they must "stand up for" their own side — they identify themselves with their opinions, as with a glorious cause.

This emotional reaction, this unalterable resistance to reason in certain matters, which we all experience, is called "persuasion" or "conviction," and has a special significance for psychologists. They know on how few questions people can be lined up on the showing of the facts. They know that persuasion is likely to be independent, even, of plain self-interest. Indeed, in the average citizen's philosophy, it is generally considered a mark of superior detachment and logic when a man does form his views on the basis of a clear perception of his own interests. It is assumed that men should be expected to differ in their opinions about principles and facts, in proportion as the principles and facts are helpful or hurtful to them. But we know that they often take positions contrary to their class or business interests, not because of altruism or devotion to truth, but because of some prior conviction to which they are hotly committed.

Persuasions are conscious attitudes, but there is a whole host of unconscious attitudes — preconceived feelings and beliefs and tendencies, which rule our conduct, as we say, instinctively. Attitudes such as we discussed — recklessness, fatalism, shrinking from doctors, disbelief in the truthfulness of management, timidity, horseplay, kicking against improvements, etc. — are generally unconsciously assumed. We do not generally stop to reason about *why* we feel strongly about certain questions. We are hardly aware of the fact that we *have* an attitude ready for all occasions on which these questions arise. We simply react.

Attitudes are of all kinds; love, hope, rage, fear, shyness, jealousy, envy, shame, and remorse are merely types. Such attitudes are emotional states of mind which we feel in connection with certain people or situations at every mention or appearance of these factors. Warren[1] says, "A man's attitude toward any situation that confronts him is quite as important a factor in his mental life as the nature of the specific stimuli that enter into that situation." And Watson[2] says, "Attitudes actually function by limiting the range of stimuli to which a person is sensitive."

The source of an attitude is not always clear. The element of lack of logic which is generally so evident to us — at least, in the feelings of others than ourselves — points to the probable validity of Watson's explanation that an attitude is the emotional outlet for a desire that has been thwarted in some other direction. For instance, take the criminally reckless man; his attitude of indifference to danger may be an unconscious pose. It may be his bid for

[1] Howard C. Warren, *Human Psychology*.

[2] John B. Watson, *Psychology from the Standpoint of a Behaviorist*.

popular esteem of his bravery, growing out of a failure to win success in love, in sport, in work, or in some other direction dear to his heart. Indeed, the spurned lover often threatens to "get reckless." Many a schoolboy, "spelled down" by the young lady who has dazzled his youthful fancy, has turned against all of his studies in chagrin. An attitude of truancy and indifference to school work generally has an emotional source remote from the outlet. It is probably true, also, of the work of grown-ups.

A sewing-machine operator in a Cleveland garment factory "threw up her job" because of a feeling that a fellow worker was favored in the allotment of work. By so doing, she forfeited her rating as an employee of nine years' service. She was told that if she were reëmployed it must be as a beginner, so far as extra payment in the form of a "service bonus" was concerned. She did later come back for her old job, and was reëmployed, but not reinstated on the service bonus. This, she felt, was an injustice, and from that time on she was a source of discord and complaint, strongly contrasting with her conduct for years past. Her attitude was not frankly related in her mind to its cause, but it, nevertheless, changed when her service bonus was restored.

A foreman in a Detroit factory was promised a salary increase on a certain date, but he received neither the increase nor an explanation. He became surly and uncoöperative, and it was six months before the reason and the cure were revealed. Such an instance appears obvious and trivial, but it is important to point out that an attitude with a very simple basis is often kept mysterious because of a man's natural reluctance to discuss the cause of an emotional disturbance, once the first noisy mood of anger has gone by ineffectually.

In dealing with the attitudes which interfere with instruction in safety principles, we have to proceed with a course suggested by these explanations of the causes of attitudes. If it is true that they are outlets for thwarted emotions, we must find a helpful alternative outlet, and, if possible, substitute it for the troublesome one. It is a well-known principle, in dealing with "bad boys," bullies, and kickers, that to make them responsible for carrying out successfully a programme which they have resisted often makes them enthusiastic boosters for it. A rebellious follower often makes an iron-handed leader. This is likely to be true, especially, where his rebellion has been related to chagrin over some humiliation, failure, or subordination. Success, in terms of leadership, may quite make up for the failure in the former case, and, with a proper emotional outlet secured, the undesirable attitude disappears.

In the cases of willfully reckless men, I think it quite reasonable to regard their attitude as a form of showing off, which is a necessary compensation for some failure. If they can get their emotional easement by success in another direction, such as promotion, conspicuous committee service, or athletic victory, they may become subdued and sensible.

The kicker can often be cured by his being assigned to a position where he has to listen to the complaints of others and must do something to answer them. A job such as the chairmanship of a cafeteria committee which has to choose menus, or as umpire at an athletic contest, will sometimes soften the mood he shows toward the affairs of the organization.

The mental set. There are times when faulty attitudes affect the whole character, and give a "mental set" which not only affects reactions to particular questions, but influences even the way the mind itself acts.

The worker of highly excitable disposition, of whom we spoke in Chapter I, was perhaps too hastily condemned as a temperamental misfit. We disposed of him as an unsafe man, who should be excluded at the time of selection in preference to safeguarding him with special protection, which we have n't time to give. For the average factory, indeed, exclusion or isolation are the only possible courses. Unless he can be wisely taken in hand, he is a menace.

And yet, strangely enough, if properly handled by patient service workers, he can often be made not only a very safe man, but an extremely valuable worker.

In every instance of excitement we observe that there is a bodily condition, an exciting cause, and a mental condition. The bodily condition — already described — is either an induced state of excitement growing out of disease, or some recent explosive event, the effects of which are still felt; or else it is an inborn responsiveness of nerves, special senses, and ductless glands. The exciting cause is an event or situation or personality which is recognized as a source of danger, pain, or pleasure. The element of recognition, however, is the important thing; it is the mental condition which translates the exciting cause into a bodily condition of excitement leading to action. No matter how responsive a man's nervous organization may be, no matter how actual the danger of a given situation in which he finds himself, if he fails to recognize a danger, he suffers from no excitement. It is the recognition which sets off the emotional explosion.

One of the characteristics of the excitable man is that he recognizes more dangers and difficulties than really exist. It is true of him, as it was of the man who said, "I have lived a long life and had many troubles, only most of them never happened!" In other words, his excitability is in part due to special attitudes, which exhibit the irrationality of most attitudes, and it is possible, by mental therapeutics, oftentimes to implant new and better attitudes.

The highly responsive man is, in this matter, an especially hopeful case. Unlike the braggart, or sullen, or reckless man who resists safety principles, the over-excitable man is usually anxious to correct his attitudes. His bodily condition and the fears and distempers which produce it are painful to him. He intensely desires to be calm and confident. A friend who wishes to help him develop new attitudes will, therefore, find ready coöperation.

The most important attitude which the over-sensitive man has to overcome is fear. He fears the loss of his job, he anticipates failure on the given task, he shrinks from possible reproof from his boss or ridicule from his fellow workers, and, if that is n't sufficient, he may either fear for his health or the health of his family. The doctor might have told him that he had a floating kidney or a leaky heart or a touch of tuberculosis. His wife may be approaching confinement. The landlord may be threatening eviction. In this state of worry he fears the ringing of a telephone, the receipt of a letter, a call to the office, or even the mere casual approach of his foreman. Anything that hints of the imparting of news looks to him like trouble coming.

He may not be a coward, with all that. He may stand physical pain without flinching and grief without despair, and may be able to force himself into the very cannon's mouth. But his lively imagination presents pictures of suffering more terrible than the actual experience of the torpid mind.

It should be admitted, however, that courage is the best cure for fear, and that the man who has learned to take punishment and has even eagerly gone out to get the discipline of punishment, has advanced halfway toward the conquest of fear. Pain, borne voluntarily for some resulting good, such as sacrifice for a loved one, or even so slight a recompense as the satisfaction of exhibiting stoicism, is not nearly so difficult to bear as pain that overtakes us in panic. The imminence of such pain's recurring cannot possibly arouse emotions of terrror when some suggestion of beauty and gladness are carried with it.

The other fears of industry can also be faced and put down, each in its own way. Fear of losing the job can be exorcised by doing a better day's work, or by opening up a savings account, so that the chance of discharge or the consequences of it, should it come, seem less serious. Fear of the personal reproaches or ridicule of bosses or fellow workers can usually be supplanted by one's going over from a passive, non-resistant attitude toward an active, friendly, inquiring attitude toward them; because it is usually discovered by that approach what really harmless, self-conscious idiots even the most forbidding persons are.

But this is not the place to expand on how to get on with people. It is necessary, only, to make the point that fears and other emotions that keep some temperaments excited are usually based on irrational attitudes, and that when the false persuasions are replaced by accurate judgments most of the occasions for emotional excitement disappear. The reoriented victim of emotionality then becomes a merely alert, responsible man, more safe from accident than the average. What he has left, after his irrational attitudes are corrected, is a finely organized nervous system, all set to "go off" at the slightest stimulus of the legitimate demands of the job.

We should not leave the question of the over-excitable man without another word in his favor. We should admit that not all the burden of calming his emotions should rest upon him. His fellow workers and his bosses have also the obligation of "tempering the wind to the shorn lamb." Fine temperaments deserve to be treated with as much consideration as delicate machinery. Harsh words and ridicule should be saved for those who can stand them without shock. Better still, no harsh words at all; and instead of the bitterness of ridicule, genuine laughter and the good will of contented men, happy in their jobs! In the proper atmosphere, almost any temperament can behave normally.

Subconscious errors. Faulty ideas and resistant attitudes are not the only forms of "knowing what ain't so." There are also quite natural subconscious errors in which the mind tricks itself, not in emotional matters, but in respect to mere facts.

At the beginning of the opening chapter, I mentioned an instance of subconscious error, where the mind made, entirely unconsciously, a faulty assumption leading to an accident. It is typical of a not rare case where our senses fail us and we jump at conclusions, associating in our minds unrealities with realities, because previous experience justified the association.

Professor Edward L. Thorndike, in his book, "Educational Psychology," points out how animals are taught to perform or act in a customary way by association of ideas. Thus, it is natural for a monkey, when a banana is thrust through the bars of his cage, to spring at it. But he may be taught by association of ideas to go to the very top of his cage as the first step in securing possession of the fruit. When a dog has been taught to sit up as a means of securing food, and has learned to identify a coaxing tone of voice with the effort and with the reward, he may be persuaded to sit up at command even though he sees no reward forthcoming.

These are merely examples of the tendency of the mind to act in an unbroken series of steps when a mental habit has been formed, and, when the process has started, to continue to the end, even when part of the occasion is removed. Thus, if a worker has become accustomed to a safeguard on a machine and for good reason deliberately removes the safeguard, he is in greater danger precisely because he has been accustomed to feel safe around the machine. His senses are lulled to sleep and subconsciously he makes errors that a less instructed person would have avoided. To avoid the difficulties of subconscious error due to misleading association of ideas, safety engineers should assume that, where safety routine is changed, all who have become accustomed to it are thereby predisposed to accident. We are familiar with the difficulties into which we fall when, having been accustomed to driving one style of automobile with brakes, gear-shifts, gas controls, etc., in one position, we change to a car of different make. In the new car, we may say we are subconsciously predisposed to accident. And when workmen change from one machine tool to another of slightly different layout or dimension, they may carry with them the mental association of their previous work and be predisposed to accident in the new situation.

In the printing department of a large tag manufacturing concern there is one type of press which has a different cam arrangement from all the rest. In the majority of the machines the upper press comes down slowly, and picks off quickly. The operator has ample time to withdraw his hand after inserting a slip of paper. But in the one type of machine, by a rearrangement of cams, the press comes together with an accelerated movement at the strike, and picks off slowly. On this type of machine the accidents are ten times more numerous than on the others. The very fact that operatives are accustomed to the presses with a slow strike may account for the accidents when they work on the few machines with a quick strike. Even continuous work on these machines might not habituate the operatives to the trickiness of a movement that accelerates just at the last second, like the spring of a cat. The subconscious factor of error might be compelling.

When a series of accidents results in any given situation without apparent good reason, we may hopefully ask ourselves: Why does the mind stubbornly fall into this error? For the greater the bent to act in a certain way, the easier it is, up to a certain point, to side-step an automatic chain of associated ideas and get on to another track. The more predictable the accident, the more preventable. At first, the situation may defy analysis. The mental key is lacking. The answer, of course, lies in the single word "association." If we can only find with what normal and innocent expectation an unsafe act is associated, we can cut out the unhappy end by not letting the chain of thought get started. The simplest and most important case of this type, of course, is the artificially created expectancy of a warning in unsafe conditions which leads to an accident when the warning is not given. Every grade crossing which is abolished by depressing or elevating railroad tracks makes the remaining ones more dangerous. The more we become accustomed to expecting watchmen or bell signals to warn' us of approaching trains at crossings, the more liable we are to take an unguarded crossing for granted as safe. The crews on freight trains come to expect the lash of suspended whips somewhat before they come to a low bridge. If, then, such warning be absent where it is needed, it might easily cause a brakeman to dash his head against a bridge, even in broad daylight.

Up to a certain point, standard conditions are a menace to safety, because, by creating certain expectation in the minds of workers, they render the exceptions to standard methods more dangerous. The remedy for the evils of standardization, however, in this respect, at least, is more standardization. Either all similar conditions and operations must be reproduced exactly alike, or the necessary exceptions must be disguised out of any apparent likeness to the expected conditions. Perhaps, for instance, if a small bell, could be attached to those tricky printing presses and caused to ring each time just before the machine picked up speed, the operative would be stimulated to draw his hand out in time. This, however, might create the expectation of a bell on all the other machines. If so, the difficulty could be solved by belling them all, and controlling them so that, whatever the speed variation between the operation itself, the bell would ring at a uniform interval before the strike.

The secret of the need of standard conditions lies in the fact that, just as action in familiar work tends to become habitual, so thinking tends to become automatic or subconscious. Given a suggestion of a familiar chain of thought, the mind tends to go on without further stimulus and complete the series of ideas that, originally, had to be personally conducted all the way. When the factory management, therefore, takes a simple-minded man and presents before him a situation or a machine that looks just like another with which he is entirely familiar, and if the machine or situation cuts a strange caper and fails to follow along the line of his subconscious chain of thought, with the result that he gets hurt, who is to blame?

The implicit sources of accident in non-standard factory conditions are sufficiently numerous to warrant a special survey by the safety committee with a view to bringing all equipment, all safety devices, all comparable spacings, to a common standard.

CHAPTER V

THE INVOLUNTARY MIND

Habit and skill. A good bowler usually rolls the ball somewhat diagonally from one corner of the alley, instead of straight down the center to the forward pin. His eye would counsel the latter course, but his arm demands an adaptation. A crack rifle shot must allow for several accommodations between his eye and the laws of physics. He calculates the upward kick of the gun, the fall of the projectile in the time it speeds to the target, and the deflecting force of the wind. If he aim at a moving target, he must also estimate the travel of the target during the time of the shot.

The good musician, reading from notes while he plays the piano, goes one step farther in removing his actions from conscious visual control. He takes his mind off his fingers altogether. With lightning-like rapidity he moves both hands at the same time up and down the keyboard. He strikes keys of different width and level — the black and the white — each less than an inch in width. Sometimes he takes them in bunches of four and five at a time. To form chords accurately he has to space his fingers into proper position on the way down — because there will be no time to do so after reaching the keys. Yet, all the while, he is forgetting fingers, and fixing his eyes on queer little black specks on paper. There is, of course, a definite relationship between these marks and the movements he makes, but it is not a direct relationship. It is an arbitrary, built-up association, and it is successfully established just in proportion as conscious normal guidance of the fingers by the eye is got away from and just in proportion as the movements become unconscious — *reflex*, as we say.

In all three of these cases — and they are merely typical — skill is built up by a process of putting the conscious mind out of business. Just as good servants require the mistress to stay out of the kitchen while the dinner is preparing, so our own bodily offices are most efficiently performed when the will is least engaged in directing them. The unconscious centers do the real work. The mind is a vast library, of which conscious thought is but a meager part — merely the page of the book that for the moment lies open. Conscious control of activity is clumsy, slow, and unpredictable. It is quite as experimental as a monkey's fooling with a toy. Your novice on roller skates, your country boy learning to fox-trot, or any person trying to write his name backward — what ludicrous efforts they make! And yet, quite evidently, a person throws a degree of conscious energy into such efforts which is far more laborious and unstinted than that employed by the most skilled performer. The latter's confidence in his work lies in the fact that he "does n't have to think about it." A good bodily habit is, therefore, more "intelligent" than the best thought we can summon.

But it is, alas, true that a habit of ineffective action can be just as authoritative as a good habit can be. The bowler who cultivates a wrong twist of the wrist, the rifle shot who habitually hurries his aim — or, worse, lags behind it — may never learn to be an expert. The musician, who, in practice, several times strikes the wrong chord at a given point, may always torture his sensitive ear with the same error at the same point.

And we should note the fact that in these cases there is a keen desire to be efficient. These practiced people may strive to be accurate and still in given details they may always fail. If bad habits have become entwined with automatic performance, they may not be disentangled without going again through the learning process. Bad habits can thus spring up in the very teeth of good discipline, like sandbars in a river channel. What, then, may the tendency not be in the formation of the work habits of men who have no such keen interest in their accomplishments? When there is no conscious or intelligent aim in the direction of activities during the period of learning, will not habits simply form of themselves and turn out as bad habits, usually, or, if good, merely so by chance?

Among people who do the burdensome and pointless labor in a factory — such as "move-material" men — there is usually little tendency to think well, and no incentive to work well. When their activity involves the safety of fellow employees, therefore, they are quite likely to cause accidents as the result of their faulty habits.

Habitual carelessness in piling material, carelessness in placing ladders or securing scaffolds, carelessness in guiding trucks and carrying dangerous materials, such as molten metals, acids, and the like, while they may be termed habits in the physical sense, are really mental habits. They spring from a faultily acquired coördination of mind and muscle.

We have already, in the first chapter, had occasion to speak of hurry as a bad habit. Inasmuch as it is only an attitude of mind, and is not in itself, specifically, a particular method of performance, such as cleaning moving machinery, or working on insecurely fastened scaffolds, it cannot be considered fully here. Yet it should be noted that hurry can become a habit which persists after all emotional excitement has disappeared and there is no further apparent reason for hurry. And it is evident, also, that the best offset to hurry, the best safeguard for nervous temperaments who have a tendency to hurry, is the formation of deliberate habits. The disposition to hurry is likely to show up most obviously in the anxious period of learning, and it is thus the chief cause of forming other bad habits. A hurried performance is a poor performance, with necessary steps omitted, or motions made out of time or out of order; and bad performances repeated during the learning period tend to become the accustomed method of work. Thus it often happens that a very eager person, anxious to acquire skill and proficiency, gives the appearance of learning quickly, and does, indeed, quickly acquire a certain speed, and then beyond that point sticks at a halfway period of haphazard, awkward performance, never acquiring expertness and smooth proficiency. His rate of output is variable. Sometimes, when he is "feeling right" and gives his conscious attention to his work, he runs up a good string of production. At other times he turns out a small output of poor work. His habits are not dependable, because formed under the stress and hurry of anxiety. He always requires a little of the excitement of the learning period in order to do even his best work. His habits not having been formed in calm deliberation, he cannot in calmness work by habit. If he lacks the stimulus to give attention to his job which he felt when learning it, he must fall back on the irregular habits of performance which he acquired as the result of hurry. The preventive for the faulty habits formed by hurry is rigorous supervision of the learning process. Proper care in learning new operations and proper attention to routine ones will firmly establish those habits of accuracy and precision which are so closely identified with safety, with quality production — even with speed. Indeed, the biggest word in factory management is *habit.*

Habit is the key to efficient work. Frank Gilbreth, by a study of workmen's movements, brought to light the fact that few workmen, even few efficient ones, habitually perform operations in the most productive way. But he showed that, where he was able to establish exact habits of movements, very great speed and accuracy could be obtained. He pointed out the value of motion study as a basis for standardization on movements of least waste, and he has lately developed very special uses of motion pictures, even stereoscopic motion pictures, as a means of analyzing motions. With a photographic record of thousands of skilled performances, he is able to study, at leisure, movements too swift for the eye itself to follow. By piecing together the most economical motions for every part of a task, he is able to set a standard better than any single, voluntary performance, but just as feasible as any. This may be imparted to learners, and thus they may, ultimately, outstrip the workers on whom the observations were taken.

Habit makes work easy in plant housekeeping. The old adage, "a place for everything and everything in its place," applies to stores-keeping in the factory. Storeroom classification and proper routine for stores issues is a method of relying upon habit to do quickly and with certainty, without having to think, what otherwise happens more clumsily by deliberate consideration. When items are stored by whim and issued on the hunt-and-find principle, the process may, indeed, call the mind fully into play. But a good system turns the job over to painless habit.

Indoctrination and morale. Habit is so efficient when rightly directed, and so easily takes the place of thinking, that good habits, if successfully inculcated, can eradicate faulty thinking. They may be marshaled against the wrong persuasions, of which I spoke before. The daredevil spirit, the fear of doctors, the stubborn resistance to suggestions by employers, or the fear of asking questions — all of them may be displaced, in the course of time, by new habits of thought. We have long been familiar with the idea that good habits of performance may be cultivated. We are not so aware of the possibility of dealing with mental attitudes by changing habits of thought. Yet, within limits, a coward may be taught to perform brave deeds, a timid person to assume the manner of the bold, a selfish person to act with consideration, and a reckless person to behave circumspectly.

Professor William James, in a brilliant little essay on "The Gospel of Relaxation," counseled how to escape from the sway of the emotions.

He pointed out that, while we cannot control a feeling itself directly, we can control the outward expressions of it. And, he asserted, in the course of time the habitual expression reacts upon and controls the emotion. It is almost true, he said, that we are afraid because we run away, that we are happy because we laugh, that we are sad because we cry — rather than *vice versa.* He would probably have agreed to add that we begin to think safety by acting safely, and even our opinions about self-preservation are colored in the course of time by our actions about safety. The reckless driver, compelled by fear of the law to drive carefully, may develop caution, even when not under supervision. The only proper way of getting people to trust the medical department is to get them accustomed to doing so. The Salvation Army asks its penitents to kneel and pray. If they reply that they would like to, but cannot believe in the power of prayer, it asks them to pray for belief. When they do, belief often comes. Alexander Pope understood the power that action has in forming the judgment when he said that —

MENTAL CAUSES OF ACCIDENTS

"Vice is a monster of so frightful mien
As to be hated needs only to be seen;
But seen too oft, familiar with her face,
We first endure, then pity, then embrace."

The promotion of right habits in a whole group of men cannot be successfully left wholly to the men themselves. Most of them lack the power of voluntary self-discipline. Many of them have positive predispositions to contrary habits. The good-habits programme needs their assent, of course; but it requires also a ceaseless vigilance of supervision. A heading-up of authority, a definite policy and theory of results, and a clearly understood administration for a definite purpose are required.

The process of inculcating right habits of thought and action in the army or the navy is known as "indoctrination." The result is known as "morale." The human subject-matter involved is less important than the process, in securing the results. There is less difference between men than between types of discipline. With a body of men selected at random, the military command sets out to produce a close-knit unit which will behave in a predictable way under fire. At a time when fear, confusion, and excitement would tend to scatter the consciousness and remove the control of intelligence hopelessly, the soldier or seaman must find ready-made courage and decision. The method of arriving at this result is practice in a routine of thought and a routine of acting from which no deviation is permitted at any time. Long use in time of training permits easy repetition in time of excitement. Automatic conduct in battle is induced by automatic drill during training — moving in prescribed evolutions with a prescribed step, carriage, equipment, and manual of arms. The contagion of example is assured by marching men in fixed, regular ranks, which step out in unison, and shape their evolutions to general commands. Respect for authority is ingrained as a habit by means of the salute, the manner of standing at attention, the prescribed, respectful response to questions, and the severe penalties for breaches of discipline. The warlike temper, even, is heightened by practice with bayonets, including the stabbing of dummies to the accompaniment of warlike cries; by quick-time drills, by ceremonies with the flag and by the use of bands, fife and drum corps, etc. So rigidly is this routine maintained, indeed, that it is as much of a military offense for an officer to permit a breach of discipline as for a soldier to commit it.

Sometimes the military régime is too severe. Many finely constituted men break down under the strain of it, suffering more from the discipline than from the battle for which it is designed to prepare them. And so rigorous a training for any ordeal less terrible than battle is not to be thought of for a moment. But that such training succeeds in its main purpose, with the majority of men, no one can doubt who has seen the great and rapid development of draft armies during the recent war. And it seems clear that some psychological principles can be drawn from the theory of habit-formation and development of morale in the army, which could be usefully employed even in the most democratic industry.

The fact that the human material involved is less important than the method of training has been clearly demonstrated in the military history of our own country. Untrained armies have been defeated in every engagement in which they have been relied upon. Where we have won, the glory of American arms has been upheld solely by meager groups of regulars or other well-drilled troops. General Emery Upton's "Military Policy of the United States" reveals some unpalatable facts about our battle records in the various wars up to and including the Civil War. In the Revolution we used twenty men to every one the British sent against us. There were only two battles which had any effect in driving the British from the country. At the battle of Stillwater, where we captured Burgoyne with 5791 men, we outnumbered the British 2½ or 3 to 1. At Yorktown, we had 16,000 men, including 4000 French veterans, against 7000 British. But at the battle of White Plains, New York, and in the surrender of 5000 men at Charleston, South Carolina, and in other engagements where we relied upon raw militia, we were defeated by smaller forces of British regulars.

During the war of 1812, the fort at Detroit with 1800 men was surrendered to 1320 British regulars without our firing a shot. Four thousand mountaineer volunteers, sent to retrieve the disaster, actually fled at the sight of a prairie fire and never reassembled. In all the war of 1812 we used 32 men to every one sent against us. We achieved only a single victory on land before the treaty of peace.

The reason for these discouraging figures is found in the fact that our defeats were sustained by men who, individually, perhaps, were all that we like to boast them to be, but who, collectively as an army, were entirely untrained and undisciplined. In the Mexican War, on the other hand, when we did have trained officers and trained armies, small outfits were able to administer staggering defeats to greatly superior forces of the enemy. In the one case, the men had developed no morale; in the second, they were indoctrinated with an habitual mode of action, and proved themselves reliable and efficient.

Morale is united action to a useful end, under single direction. Factory management has, in general, never appreciated the value of cultivating morale. This is due to the fact that management hesitates resolutely to build up discipline. The error is usually made of thinking that factory discipline, of the degree of completeness indicated, would require a military authority at which workmen would rebel, and which they are under no compulsion to accept. This is an erroneous impression. It is possible to secure "united action to a useful end, under a single direction," by voluntary assent and by democratic decision. I admit that, in the factory, this is the only way in which such discipline can be got. But the determination and initiative must be furnished by a resolute management.

Despairing of securing discipline by military methods, industry has ended with having no discipline whatever. It is true that, in the minor matter of enforcing a decent outward respect for the dignity of the boss, management will fire a workman instantly. In the more important matters, however, relating to manner of performing work, acceptance of safety principles, cleanliness, and economy, discipline is less frequently enforced. Workmen are hired in the presumption that somewhere they have been thoroughly trained, and so are left entirely to their own devices. In most plants they are even denied the pleasure which comes to them as a result of united action in securing economy and efficiency.

Resistance to efforts to form correct work habits comes less frequently from actual workmen than from theorists about industry. Precisely because scientific management, with especial reference to time and motion study, involves careful training in good habits, many social workers oppose it on the ground that it deprives the workman of initiative. This criticism, however, fails to take account of what we know about habits. It seems to assume that, if left to himself, a workman will take conscious thought of his action or method of performing work every time he has a task set before him. But a workman who has to do this cannot be considered skilled. As Myers[1] says, "The worker, whether trained or not, will ultimately fall into some habitual method of procedure." Scientific management merely undertakes to

[1] C. S. Myers, *Mind and Work.*

see that, in the formative period, when habits are making, the workmen have the benefit of scientific study in choosing among various possible methods of performance. I wonder if the critical social workers will go so far as to assert that the particular method which conserves human energy, and enables workmen to earn increased pay without increased effort, is a less desirable and less interesting method of performance than some faultier habit at which the worker would arrive by chance! I should rather say that the complaint of those who love men should be that management so seldom does discover the methods of least waste in performing tasks. The grievance is that workers are allowed so often to stagger unwarned into ways of costly waste of effort, or into careless habits that foster accident!

The discovery of the best method requires a comparison of methods of doing work which a single workman has not the opportunity to arrange. The formation of correct habits involves a degree of painstaking care which requires the assistance of supervision. What Professor William James wrote in his chapter on "Habit" is still valid. To re-read this chapter is to be convinced anew that it takes a great deal of machinery to form correct habits. But it also reminds us that correct habits, once formed, are not alone the basis of skill, but also the means by which routine can be handed over to subordinate nerve centers and the mind set free for "new business."

In considering the question of discipline and habits in the factory, from the point of view of safety, it is important to take up the whole question of discipline of work habits, because it would take nearly as much organization and supervision to cultivate right habits relative to safety work as to extend the theory to every phase of work.

To make sure that employees always remember not to stand or sit or fall asleep in a dangerous place; that they always avoid repairing or cleaning moving parts of a machine while it is running; that they always set the guards or locks; that they always wear goggles or gloves when necessary; that they always have the doctor dress small cuts and scratches; in other words, to assure that the routine of safety procedure is not left to the judgment or conscience of employees, but is handed over entirely to habits, is a highly exacting programme. It requires a vigilance of supervision which very few industries are organized to give. Economically it is hardly worth while, for the sake of safety alone, to establish such discipline. Certainly it *won't* be done for the sake of safety alone; because management is all of a piece.

How to cultivate safety habits. A programme of proper habit-formation for safety in a factory should be based on the following procedure:

1. Determination of safe habits to be inculcated.
2. Indoctrination, on the principle of the "greatest common denominator"; i.e., the use of mental laws of the most universal application.
3. Drilling beginners in proper habits (not merely ideas, but habits) of safety, as part of the process of learning the operation.
4. Building up a check-list of habits to observe in safety inspections, formanizing, etc.
5. Constant inspection, with use of this check-list.
6. Making opportunities for reporting instances of bad habits.

7. Studying accidents that occur, to revise check-list on safety habits.

We may profitably pause to consider these steps briefly.

While it is not possible here to set down any universal set of principles on safety habits, it is easy to point out several that ought to be included in almost every set of rules. For instance:

Safe clothing: Permit no one to come near moving machinery with flowing or torn sleeves, neckties, or other garments which may "catch." Require women workers to confine their hair with caps. Where gloves are worn at hazardous work require the fingers to be cut out.

Ladders: Permit no ladder to be set at an angle of less than 60 degrees. Provide secure hold on floor by points or suction caps, and a secure rest above. Permit no worker to disregard these points.

Hand tools: Use tools in the right place; permit only certain tools to be used by certain men, permit only the right tools to be used, and permit no one to use hammers' with mushroomed heads.

Similar and obvious rules can be formulated for cleaning machinery (tagging machines under repair, etc.), walking on wet floors, keeping aisles clear, and using goggles, guards, locks, and other familiar safeguards.

In the enforcement of such habits, it is necessary to treat them *as* habits; that is, as involuntary acts, rather than as matters of intelligent and deliberate choice. The adoption of such methods of performance cannot be allowed to wait for voluntary action of the workers, nor in all cases even for their complete understanding. The greatest common denominator in mental life is unthinking habit. It is the only thing which may be reliably inculcated in all minds above the grade of idiot. And the way to form habits is to perform. No mere explanations, but actions, do the trick. Explanations, indeed, are unnecessary if the act can only be brought about once, and then repeated often enough. It need hardly be said, of course, that the more democracy a plant can introduce and the more discussion of such rules as the above, before adoption, so that full and general consent may be had, the easier it is to inaugurate good habits. More intelligent men can only be handled that way. But discussion has nothing to do with forming the actual habit; only action can do that — only undeviating performance. Moralizing over breaches of discipline should never be allowed to supplant the steady application of good rules, the steady performance in accordance with right habits.

Usually, careless habits are an evidence of unintelligent training or entire lack of training. In one sense, of course, they are also an evidence of lack of self-discipline, in that they reveal a lack of intelligent self-schooling in the right way of working. It is only the abnormal person, however, with an almost irritating passion for neatness and care, who voluntarily trains himself to work always correctly, in a precise manner. Early education may occasionally inculcate a mental set in favor of care in *all* things, but few persons have this inbred disposition for the conscious formation of right habits. Correct habits must, in general, be supplied for *each* type of work undertaken, as the result of conscious discipline by management. The theory must be that, first, *all* men work by habit — good habits or bad habits; second, that these habits are formed in the process of learning or directed re-learning; third, that, except in rare cases, learners do not consciously steer themselves in the direction of forming good habits — their course is picked out blindly; and, fourth, that it behooves management, therefore, to assume charge of the process of learning, and to choose for beginners those motions and methods of work which, when later followed habitually, will keep them safe and make them successful. This means, in work, the development of something akin to "form" in golf or tennis — a certain way to stand or swing to give the freest and most comfortable play, to secure greatest stability or quickest response, as the case may be, and to conform to the laws of physics in the application of forces. Not only because habits are more easily formed in the process of learning, but also because at no other time does the workman so consciously and willingly put himself under the guidance of management, indoctrination of safety habits should be made a part of the process of training beginners. If in any given factory there is no formal training for new workers, or in given cases such training is not considered necessary, the foreman should regard the newcomer's first few days at work as a learning period, and give him, on the job, pre-planned instruction in safety habits.

It requires constant inspection, of course, to maintain correct performance. Just as a boxer needs a sparring partner, or a practiced actor needs repeated drill in elocution, so executives need repeated stimulus to perform their duties fully. A system of safety inspection is indispensable, and it should have regard not only to mechanical features, but also to performance habits. For this purpose a check-list covering all the points in the rules for safety habits, and a few others, should be used to guide the audit.

Supplementing the inspection by safety committees, or safety engineers, or even outside consultants, there should be a system for reporting laxity of habits. A set place in the order of business in foremen's meetings, shop committee meetings, and the like should be reserved for reporting breaches of these rules of safety.

Finally, the accident itself, when it does happen, should be used to instruct all hands in all its various aspects. And one of the several things to ask about an accident is, Would a good work habit, not yet formed, have prevented this occurrence?

CHAPTER VI

THE DIVERTED MIND

Habit and attention in relation to safety. The ideal mental state for performing routine work safely is not easy to picture, for there are elements in it which seem to be at variance with each other. As we saw in the last chapter, repetitive work is most skillfully performed when all motions are strictly habitual. This seems to mean that attention may be entirely withdrawn, and is, indeed, better withdrawn, from the work. We saw, too, that habits of safety can be linked up with habits of performance. Yet many safety engineers will tell us that work can become too familiar, that overconfidence breeds lack of caution, so that accidents may result. I have even seen working by habit listed as one cause of accidents.

It is possible, however, to effect a reconciliation of these ideas. The confusion really results from failure sometimes to perceive that there is more in a job than the method of performing it. There are always at least three mental phases to any performance of any task.

There is, first, the standard, permanent, habitual, or method, phase, which should be strictly automatic. There may sometimes be alternative methods, or even numerous variants for each element of performance, which are chosen almost without conscious efforts in response to slight variations in the job; but each variant should, in itself, be automatic.

There is, second, the non-standard, immediate, relational, infinitely individual phase — the something peculiar to the moment — which makes each separate performance of any routine task different from every other performance of it. Even if carried through a million times, no two performances will occur in exactly the same way. The operative, himself, not only grows older by the minute, but he alters his mental and physical state constantly. The atmospheric conditions, the illumination, and the conditions of the machine, of the tool, of the material and of the power, vary through an immense range of possible gradations. The accompanying circumstances, not necessarily always but usually vitally related to the given performance, occur but once and change instantly, never to reappear again in just the same combination. Even the seemingly automatic phases of a job are shot through with the unexpected or with the necessity of choice. The time to start the performance must be deliberately selected; often the time to stop it or interrupt it in response to trouble or danger must be fixed by conscious decision of the operative. Breaks in the machine or the work, or defects in the tools or materials, must be watched for and appropriate action taken.

Finally, the third phase of performance is the value, or meaning, or interest phase, which often changes from time to time, and always varies according to who is performing the task. The performance has a meaning, intellectually, according to how it fits into the general scheme of things — whether it is useful or harmful, necessary or trivial; and above all, according to how much of its relations are understood by the operative. It has a value, emotionally, according to what desires or instincts of workmanship it gives play to, and how much of the workman's own will and initiative have been engaged in the decision to perform the task at all, or in these circumstances. It has a value, socially, according to the esteem in which it is held by others, or the amount of present attention it is receiving from executives and fellow workers. It has a value, physically, according to the effect on the health and sense of well-being of the performer. And it has a value, economically, according to whether the pay for performing this task is going to give the worker the thing he considers necessary to his existence and his happiness.

All three of these aspects of task performance — the standard phase, the immediate phase, and the value phase — have different influences upon the operative's attention, and different meanings, therefore, to the safety engineer. Clearly enough, the second phase, the non-standard, immediate, never-to-be-repeated aspects of performance make a definite call upon the attention. The uncertainties may be ever so slight, the dangers ever so remote, and the chance of exciting incident and change only too slim, but there is always the possibility of some important thing happening. The mind must be ready to deal with it when it comes. Indeed, if the mind is *not* ready, the important thing may be a serious accident, due to the failure to respond to a slight demand upon the attention. Any performance of any task, then, because it is always related to the exquisite unexpectedness of life, requires some conscious attention. Now, it is at the same time true that, just in proportion as any given performance resembles those which have gone before it, the worker's action should be automatic. The mind can consciously attend to only one idea at a time, and any focusing of the powers upon the manner of doing the job necessarily withdraws them from the reserves to the active engagement. Attention must be devoted to either one phase or another, either to the method of doing work, or to the present situation with regard to it. Good habits, therefore, by releasing attention for the unexpected developments, are aids to safety.

What safety engineers have in mind when they say that a worker can be so familiar with a job that overconfidence leads him into dangerous practices is that he is bored because something is really wrong with the third — the value — phase of the performance. Many things are likely to be wrong with this aspect of a factory job. It may not pay enough, or it may not have been made to seem important to the worker, or it may be injuring his health, or thwarting some fine instinct or desire. So long as the job is fairly new, the mere interest of exploring its meanings or overcoming such difficulties as it presents may give it a value which holds the attention to the two primary phases of performance. Repetition dulls and finally kills these temporary values, however, and unless the social or economic or other personal values remain (as they may remain, permanently), all interest goes out of the job. The stupidly familiar task cannot hold the attention. The distasteful job sends the mind fleeting to other fields, because attention is inextricably linked up with either positive interests — curiosity and pleasure; or with negative interests — fear and pain. It cannot be held to any unpleasant thing which it can escape. The most dangerous mental situation, therefore, attaches to a job with which the operative is thoroughly familiar, in its automatic phase, but relative to which he is thoroughly *un*interested by its value phase, and which, in its immediate phase, permits him to be easily distracted by confusion or worry in the attendant situation. The uninstructed learner is safer than such a worker, because the former's lack of automatic skill compels him — whether the job offers other elements of interest and value or not — to give attention to the immediate phase, of which his learning the process is, for the present, a part. But the most favorable situation for safety is the one where the operative is skilled in the standard movements, and yet held by an intense interest in the several value aspects of the job to give close heed to the immediate aspects of the given performance.

The safety engineer's task in dealing with the related problems of attention and habit, therefore, seems to me to be fourfold:

1. To inculcate *safety* habits.
2. To assist in establishing correct *performance* habits, or automaticity.
3. To help to build up the value aspect of the job by building up positive interest in it.

4. To minimize competing interests, distractions, confusions, needless difficulties and worries.

Perhaps it is unnecessary to point out that the value aspect of any performance is largely a subjective matter with the performer. The mere doing of a task may so gratify one worker's instincts that any other value is superfluous, and another may find the doing of the task, or the continued repetition of it, so disagreeable, that no other value can compensate. "One man's meat is another's poison." Before attempting, therefore, to do anything to give new value to jobs, the management should see to it, first, that men have been selected for those jobs who are likely to find them interesting. Nervous, high-strung men should not be kept on repetitive tasks, nor phlegmatic men put on jobs which constantly change. Men of poor ability should not be worried by assignments beyond their capacity for self-satisfying performance, and superior workers should not be confined to mediocre efforts. These things are, in themselves, well recognized. It needs to be somewhat emphasized, however, that they also have an indirect bearing upon safety, through their influence upon the attention.

Boredom and values in relation to factory routine. In the minds of most people, monotony is associated with boredom. As they cast their eye over the field of industry and observe how large a percentage of the work is routine, repetitive, and trivial, critics of the modern order cry out against the monotony of such labor. They envision the state of mind of the workers as a mood of depression and intense boredom.

The situation, fortunately, is not so bad as it appears. The majority of workers find satisfactions in their jobs which observers cannot readily see. The majority of unskilled operatives are people of meager ability, unfitted to deal with complex situations. They have come to the jobs by a process of natural selection and experience which has shown them the field for which they are fitted to make good. Usually the routine job offers as much excitement and variety as they are capable of dealing with comfortably.

THE DIVERTED MIND

There are two ways in which boredom can affect attention to the job:

Either (1) by the workman's having no interests whatever which the job can serve directly or indirectly;

Or (2) by the workman's having intense and lively interests in activities which compete with the job. If he likes another kind of work better, or if he cannot wait through the working day to get to his play, he is bound to be bored with his job.

The average worker, however, is not really bored. He is reasonably contented so long as he has "good running work." He falls somewhere between the two types of men mentioned above. He is not so stupid and dull as to have no interests, nor is he so eager for life as to have many competing interests. He has rather a mild, routine attitude toward life, which accepts with gratitude the ordinary unfolding of home life and of work, and fears only the unexpected.

The average man of settled habits is, from one point of view, a cheerfully defeated man. Originally, he had a boastful, gleeful, hopeful attitude toward himself, and an easy contempt for the world. He expected always to make good money, to enjoy enviable good health, and to maintain before other men the reputation for being a good drinker, a heavy smoker, and a success with women. A few years' battle with life, however, usually brings a man to a vastly different frame of mind. His manner of living in his youth has cooled his vigorous ardor, even if it has not enfeebled his health; his contact with the hard facts of industry — unemployment, among them — has impaired his confidence in his ability always to make good money, and substituted an ever-present fear that he may suddenly find himself "dead broke." His family life has not been so much of a personal triumph as he had expected, and, instead, has been the source of many sorrows, humiliations, and disappointments. There are, indeed, few objects upon which he can turn his mind, to derive therefrom the hope, the self-esteem, and the excitement he found so readily in his youth.

On the other hand, while his youth was hopeful, it was often, in its immediate experiences, quite hard. There were deprivations, postponements, and defeats such as he no longer has to fear, and such as, at that time, it took all his egotistic hopes to sweeten. To-day, at least, if he expects less than he formerly expected, he gets more than he formerly got. He must be content with a less brilliant career than he had pictured, but in the end it is likely to be the one that satisfies most of his creature wants, which often had to be denied in his youth. The process of maturing has been a process of finding the situation, in work, marriage, etc., which, on the average, guarantees him the most permanent and regular satisfactions. The picture has gradually changed, the hope gradually dwindled, as the permanent situation became clear, and the worker saw that his die was cast, his lot chosen forever. So it comes about that, instead of the boundless potentialities and uncertainties of his youth, life has presented him with an adjustment. He has had to settle his suit out of court, so to speak, and take a fixed sum. It isn't as much as he had claimed, but it is a tangible amount, in hand.

In this final scheme of things the job has come to weigh very heavily. It is his means of livelihood; that is, his guarantee of maintaining the adjustment which compensates for the loss of his youth. He is never able to forget for a moment its symbolic value, its meaning as the key to his daily existence. And if perchance he is a good workman, and the task presents a normal amount of difficulties which he is able to surmount, the job has a further value in ministering to the remnants of his egotism left over from his youth. His family life may be going like the devil, and his appearance before his fellow men somewhat ludicrous, but if the job itself furnishes its little daily triumph, there is still some hope for him, still some pride and manhood. Let no one too hastily assume, therefore, that the workman is bored by his job. If his personal life is well adjusted, his job is quite likely to maintain a steady level of interest.

It is easy to see, however, that in the cases of young men who have not yet found themselves in life, or of older men who have failed to make a satisfactory adjustment, the average job is less likely to give satisfaction. The steady job is for them no key to their happiness, for they have not yet found contentment. In so far as it is a mere "meal ticket," it may become distasteful, as the anchor to an existence which has not been made tolerable.

In such circumstances boredom as a state of mind is inevitable; the only offset is an increased excitement and variety in the work itself. The job must bear the additional strain of compensating for the lack of satisfactions in the life adjustment. Either the work must be made, clearly, just a stepping-stone to promotion and some form of renown, or else a direct means of satisfying the manifold range of compensating instincts. Artists, musicians, actors writers, politicians, social workers, and organizers are, in a surprising number of cases, out of normal adjustment to life, yet they find happy compensations in their work. Factory employments, however, do not usually offer such satisfactions. The number of maladjusted people who drift into industry through inability to pursue a more exciting career is so great that there exists a genuine problem of infusing new interests into repetitive work. Right here, we find the explanation for boredom and inattention, which justly concerns the safety man, and, if he intends to deal with the mental aspects of safety in a fundamental way, he will study the means by which a factory job can be made something of a career.

Account must be taken of all of the instincts of human nature; the motives appealed to by the advertising specialists for foods, clothes, and cosmetics must be utilized by men who advertise safety. The human appeals made by good politicians building a municipal machine must be made by those who attempt to organize the good will of workmen around a safety programme. The safety movement did not begin to have any effect in reducing accidents until safety engineers learned to give more attention to committee organization than to mechanical safeguards. When they discovered that they could corral the impulses and interests and energies of the workers by means of putting them to work upon each other, they began to achieve exhilarating success. And yet, only a good beginning has been made. The employee representation idea carries the development one step farther. When social organizations, recreation, steady employment, good pay, and intelligent management of processes go along with these things, more and more of the workers' normal interests are mobilized around the job and a happy atmosphere is secured.

There have been many approaches to the problem of putting new interest into a job otherwise monotonous. Frederick W. Taylor, father of scientific management, probably first brought to a high development the most reliable means. He gave the workman a definite standardized task, properly prepared tools, detailed and accurate instructions, including a blue-print, and payment in proportion to output. He put in, also, a little extra pay for reaching a standard day's work. Mr. Taylor, by these devices, at once gave the worker a means of rating the efficiency of his own job — a bogey score, such as golfers play against — and a reward for application which enabled the worker to relate in his mind each particular piece he produced to some desired expenditure of money outside of work.

With the young and ambitious worker, the job is not so important for what it pays, or any of its other immediate aspects of pleasantness or repugnance, as for what it guarantees in the way of advancement. A clearly defined promotional scheme, a system of transfers, an apprenticeship training schedule, a plan for rating operatives, or any other method of singling out and pushing ahead the successful, eager young man, automatically invests with new interest any job to which it is applied. So, too, a system of instruction for given jobs throws around them a glamour of prestige and interest, as well as raising hopes of advancement.

I am inclined to believe that these things are fundamental, but certainly other leaders have added much to the devices for creating interest in the job. Mr. Robert Wolf has given ample proof of his ability to stimulate increased efforts without the immediate financial inducements of piece-work, merely by keeping scores on workmen and letting them compete against themselves to improve their records. Indeed, by making these scores relate to the efficiency and success of the whole plant, and not merely to an individual bogey, Mr. Wolf has unquestionably enlarged the scope of this type of incentive.

Mr. Henry T. Noyes, General Manager of Art in Buttons, Rochester, New York, has made an additional contribution in the matter of scientific determination of needed rest periods and in the matter of the proper use of rest periods. Various groups of operatives in his plant are allowed from three to twelve minutes in every hour, according to type of work. The power is shut down and no one is permitted to work. A rest period is taken up with music, dancing, or games on the lawn. To those who are skeptical about such arrangements, the best answer is that Mr. Noyes came to this schedule as the result of years of patient experiment, and is convinced that, by these undisturbed periods of rest and entertainment throughout the day, he is securing increased output, better quality, a lower accident rate, and a permanently satisfied body of workers.

Something must also be said for the development of democracy in shop management, with which the name of John Leitch has been most widely advertised, but in which the great body of experience either antedated, or has arisen independently of his work. So much is covered by the term "shop committee," however, and it can be so damaged by awkward handling, that I do not feel like dogmatizing on the subject. Probably, it will be generally admitted that a stable factory organization may safely and profitably give the steady employees an ever-increasing voice in the solution of management problems. There can be no doubt that, if permitted to do so, they will find an interest in the job far greater than mere work for better earnings can give them. One has only to read Ordway Tead's "Instincts in Industry" to be reminded of how many more things there are in work than taking orders and drawing a weekly pay envelope.

Distraction and inattention. There was an automobile body manufacturing plant in Detroit which had so many accidents in the wood-working department that it became known as "the slaughter house." In running circular or band saws, workmen frequently made false movements and cut their hands instead of the lumber. In one particularly bad month, twenty-seven fingers were lost. This brought matters to a crisis. The management was more or less conscientious. They faced the situation humbly and finally came to the correct conclusion that the real trouble did not so much lie with the workmen as with the fact that scheduling and plant housekeeping were both as bad as possible. Trucks of material blocked all of the aisles; finished pieces were not removed promptly, or in proper sequence; stock chasers were running all over the plant for what they needed. The workmen on piece-work at one time were laboring under the double pressure of the foreman's demands and their own desire to boost their earnings. At other times they were waiting for material blocked at previous machines. A general atmosphere of physical and mental confusion prevailed. Periods of hurry and anxiety kept men distracted when their attention should have been fixed in an orderly and peaceful way upon the dangerous task in hand.

At last the company introduced an efficiency engineer who had done good work in a neighboring plant. In a very brief time he straightened out the scheduling and the material movement. There followed promptly a noticeable reduction in the accident rate. The unsavory reputation which the plant had had with its workmen was improved and the company was saved from being dropped as a bad risk by a mutual compensation insurance company.

Another plant in Detroit in which I was interested once sent for Alvin F. Knobloch, President of the Cleveland Tractor Company, and one of the most thoughtful managers in the country, to report on its management methods. We had spent money freely in buildings and equipment. We paid good wages. But we were not proud of our production record. And our accident situation was giving us anxiety. Mr. Knobloch very promptly put his finger on the difficulty.

"You have too much confusion here," he said. "In a building in which space has been wasted, your aisles around the actual work places are too narrow. Your workmen are crowded. Your routing of cores and chills and patterns, apparently, is not good, so that your men sometimes have to yell for more work and sometimes have to stand off the subforemen who are yelling at them for output. I feel inclined even to criticize the noise and the bad ventilation, as adding to the distraction of the men's minds from their work. I consider no outlay upon planning and upon other phases of management too great, if it has for its purpose and result the putting of the minds of the workmen at ease. Let nothing trouble your workmen, and they will give you no trouble."

Of course, Mr. Knobloch was not asking for an unnatural state of calm, impossible in a busy plant. People can become accustomed in their usual round to what, to an outsider, looks like confusion. A person who lives amid all of the noises of a city finds it hard to sleep when he spends his first night out in the country. Soldiers returning from the battle front are said often to experience difficulty in getting to sleep when they climb into a real bed in a quiet room. A man who works in a boiler factory or a man who is accustomed to riding on noisy vehicles may be "used up" by his work — particularly in the course of his lifetime — but he is not distracted by it. Plants that do not ordinarily admit visitors find that it disturbs workers when a stranger in a fur overcoat or a lady with kid gloves is conducted through the departments. But the Ford Motor Company, which takes visitors through in groups of twenty-five or more constantly during the day, and puts through the back door more sightseers than flivvers, finds that no disturbance whatever is occasioned by a thing so common.

Confusion which distracts attention arises either from unforeseen contingencies or from a management situation in which nothing is preplanned. The peaceful state of mind, which Mr. Knobloch declared to be so necessary, depends upon the management's creating a situation in which the workman knows precisely what to expect, and in which he is shielded from the unexpected. Excited or angry bosses, conflicting orders, delays in the flow of material, failures in the basic service activities, such as heating, lighting, water supply, etc., fights among workmen, even accidents to other workmen, all tend to distract the attention from the work in hand and to make accidents possible.

It would be an error to assume that workmen stumble into accidents only because of ignorance, depression, or wrong "mental set." A man may be intelligent about accident risks, anxious to avoid them, in excellent physical condition, and intensely interested in his job, and may yet sustain an accident through a temporary distraction of attention. This will be particularly true, of course, of certain temperaments. The too responsive individual will be too easily interrupted. Every passing disturbance will distract him.

During the learning period, when new work is being taken up, an extra degree of conscious attention is needed to assist in the formation of safe habits and right ways of thinking. A mental diversion at such a time may easily result in an unlucky slip. Nor are newcomers the only learners. Conditions in a plant are always changing; men are always transferring from department to department; new men come in; slightly new conditions are introduced into familiar jobs; the type of work on a machine is changed. The indoctrination of the new forces, and even of the old forces, with correct habits, must go on continually and without the hope of ever achieving 100 per cent success. Unceasing attention to the problem of safety is therefore, needed on the part of all workers.

Sometimes the very novelty of a job and the demands it makes will help to focus attention to an extent which will cause the mind to resist distraction. In a familiar, routine task, whatever the degree of interest, whatever the value content, the attention is more lightly held. The work may go on for hours without the worker's being keenly aware of where he is. The mind is free to range in reverie. Those who overlook the immediate, non-standard phase of any performance would say that the job is so automatic that attention is superfluous. Yet we have seen that even in such work a certain degree of attention is required, because the work certainly does not go of itself. It requires at least consciousness, and something more. The mind may seem to wander and may even safely do so, provided it is not engaged in what we might call a responsible mental activity, or if it is not engrossed in an active emotional state. But bring it up shortly, with the necessity of an immediate decision on a question, or let it be agitated with fear, anger, or any other excitement, and effective work stops.

In general, production executives do not thoroughly understand the requirement of situation and mental atmosphere which comports most naturally with the efficient conduct of routine work. It is known that directed thought is not required to do skilled work of a repetitive nature, and that habits take care of such work. It is known, also, that while doing such work the mind has a certain liberty of action to occupy itself with other things. Yet it is not appreciated also that, when the attention crosses some mysterious threshold of thought or of emotion, there is a united action on the part of the whole organism which causes routine work to stop. Perhaps we can use the phrase, "the actual situation," to describe the state of mind which distracts attention from routine work. When the mind crosses the border-line of consideration of imagined or indefinite possibilities, to deal with real and immediate things, when it ceases to range over the future prospect or past experience and passes into the immediate present, it undergoes a fundamental change of attitude. The physical or mental or moral situation which exists at the present moment seems to require an act of decision, or at least a directed examination of the facts. There is a subordination of lower nerve centers and a concentration of attention which assures that the entire forces of the individual's mind are directed to one aim.

Such a mobilization of energies is part of our animal inheritance. An animal whose life is hunted by another, or which must secure its livelihood by hunting others, may sleepily contemplate the prospects of a life-and-death chase without more than a twitch of the whiskers; but the moment it is confronted with an actual situation — say, with the sight of an antagonist — its whole being suddenly changes. The muscles tighten, the eyes flash, the hair stands on end; the agitated beast is poised for instant pursuit or flight. Even men, in danger or excitement, experience the same pulling in of the energies. The mind is occupied with a single purpose. In the excitement of combat, fearful wounds are not felt. Minor inconveniences are not even noticed; nothing in the entire scene engages the attention save the object of fear or hatred. Sometimes the very basic functions of speech and hearing and ability to walk are paralyzed, if excitement is too great.

It does not require a circumstance so engrossing as this to distract the attention from normal procedure. Lesser excitements produce lesser concentrations of energy. The human personality is wont to economize its resources by holding all forces ready even at a threat of attack. Perhaps, with this, we can understand that, while it is not always possible to analyze just what will interfere with routine labor, we can generally understand that there is a type of thinking which permits diffusion of energies to several tasks, including routine work, and another type of thinking, usually connected with an actual situation, which brings them into focus. When the highest nerve centers are vitally engaged, the lower ones are inhibited. When fear or excitement direct attention to some situation, the digestion itself halts for the moment, every energy is subordinated to central brain control. Thus we see why a violent distraction not only draws attention away from the immediate, non-standard aspects of performance, but even somewhat paralyzes the automatic element.

The management which is interested in safety will not alone see to it that attention is normally given to routine jobs because they are interesting, but also will preserve the worker from interruptions which interfere with *both* attention and habit.

CHAPTER VII

THE TROUBLED MIND

The emotional crisis. "He was fired only an hour ago," said the foreman. "He went back to clean up his machine and got hurt."

Here was a case of a man, "mad clean through," or sick with anxiety and shame at having received his discharge, who was careless in winding up his job. He stuck his hand into the gears and received a bad laceration. So, instead of passing in his tool checks and drawing final pay, he found himself in the hospital. A flash of keen emotion — that was all, but it put him on the retired list for ten weeks.

There was a steady workman in the coreroom whose piece-work production was often the subject of dispute with the tally clerk. Bad blood arose between them, as the workman became convinced that the clerk was deliberately altering the records to lower his pay. The coremaker kept an accurate count on his own output, to check up against the office records.

One day, when the third pay envelope in succession showed a shortage, he left his bench in hot anger to pursue the tally clerk for a correction. In running, he stepped on a piece of gas-pipe carelessly left on the floor. It rolled under his foot throwing him to the ground and breaking his arm. The pipe, of course, "had no business to be there," as the accident report stated, but the reason for the mishap was quite as much the state of mind of the injured man, for, in ordinary circumstances, he surely would have avoided stepping on the pipe.

A lathe operator was given a "bawling-out" by the foreman for a piece of defective work. The workman considered the reprimand unfair, because he had complained of the tools furnished him without getting any attention. The foreman, however, was not disposed to allow for that, and told the lad that if more work were spoiled he would not alone be docked in his pay, but would have to "go out and find himself a job as a junk-man!"

This final insult so roused the operator that he resolved to complain no more of the faulty tools, but to grind his own. As soon as the foreman was out of sight he snatched up a cutting-tool and ran over to an idle grinder, turned it on himself, and pushed the tool up against the side of the thin emery wheel. The wheel exploded under the awkward strain, and a piece flew up, cut his eyebrow, and laid open his cheek so that for the moment it appeared that he had lost an eye. The accident report blamed the worker for disobedience of orders, but it seems that the real cause was less the fact of his grinding his own cutter and rather more the ill-considered manner of his grinding it, due to his state of hot temper. Ordinarily he would have known better than to shove the tool against the wheel so wickedly.

To the person who casually passes through a factory department things may ordinarily look all serene. The belts turn, the machines sing, or groan, or pound, in a regular, monotonous way. The workers rarely talk, or only in impersonal snatches. The straw boss moves about, shouting briefly in this one's ear or calipering a sample of that one's production. The dull seriousness of the life would apparently calm rather than produce or aggravate emotional strain. And yet, if we could only look beneath the surface and take a survey of the states of mind of the men in a given room, what a turmoil would be opened up to us!

Indeed, let us imagine for a moment that we are gifted with a kind of second sight, and are able to get into radio communication with the hearts of these quiet, laborious machine tenders. Let us walk through the aisles of a factory and halt before each person we meet, and eavesdrop on his inner life. Some, we shall find, are too stupid to present to us any thought worthy of our attention. Others are phlegmatic. Most of them, indeed, are engaged in mere reverie — a stream of impressions, recollections, and vague wishes, too nebulous and fleeting even to be formed into words. The semi-automatic nature of the work allows the thoughts to play in this fashion, and the ordinary mind in ordinary health will, in such circumstances, roam in the same aimless fashion at work as in sleep. At the end of the day it will be as difficult and as pointless for the automatic machine tender to try to recall what has passed through his brain as we find it ordinarily to repeat our dreams.

Let us ignore such cases, and pick out those whose states of mind have a significance for our inquiry into the causes of accidents.

Here, for instance, is Bill Harper, a fairly new worker in the department. He is a youngster — only twenty-one — and not very patient. He spends his money on a "steady girl," and is not quite satisfied with his piece-work earnings. He is broaching brass-bearings, and the stock is n't good. The molders have managed to get sand into the metal and the broach tears out chunks of the stock where it ought to leave a clean cut. Bill has called this to the foreman's attention to-day, yesterday, and the day before. The foreman had a row with the foundry superintendent over it yesterday and came off rather badly. To-day he hesitates to renew the discussion, and has tried the experiment of blaming Bill. He has just told Bill that he could n't broach holes in a Swiss cheese without spoiling it. In a few minutes the inspector will come around and reject twenty per cent of all that Bill has produced this morning. Bill sees his pay dwindling, and, when we find him, he has just decided to take his girl to the movies to-night instead of to the vaudeville, as he had promised. What he feels about his foreman is good! As we leave him, he is still putting one in and taking it out, putting another in and taking it out — calm and steady, to all outward appearances; but he will shortly broach a piece out of his finger.

Meanwhile, we find ourselves looking in on the thoughts of one Mike Lados. His name was Ladoslodovitch, the last place he worked, and before that he called himself Stanley, because the first name of the employment manager was Stanley. The boys liked that employment man and ten of the Polish workers changed their names to Stanley. Our friend now calls himself Lados, however. Mike is putting the babbit-linings in bearings. It is a sweaty, tiresome job, and it keeps him moving. As he squints at his red-hot work he seems all absorbed by it, but he is looking through it, into his little house in Hunky Town. There is a crisis at home. For seventeen years in America he has saved money to go back to the old country. His first wife died, leaving him six children. His second wife, a younger woman, brought him another child last year. The financial strain of rearing a family has made saving difficult, but Mike had got ahead two thousand dollars. He did n't put the money in the bank, but hid it in the house. Day before yesterday his wife took the money and decamped with a young boarder in the house. She left all the first wife's children to Mike and took her baby. Mike stayed out from work one day, and then came back on the job this morning to begin saving again for the trip to Poland. The children are left in the care of the oldest girl, and as we see Mike he is searching his soul on the question whether he is glad that his wife took the youngest child. He always played with the baby when he got home at night. Would he rather have the care of it now, he wonders. It is a deep question, and Mike finds it hard to keep his mind on babbit metal. We hope that he does n't spill any of it on his foot.

The next man, Grant Simpson, is now acting as a stockroom clerk at sixteen dollars a week. Before prohibition he drank his money up in saloons, and fell from one position to another. He began as a salesman, rose to an important office position, but as the result of his bad habits he lost step with the world. He has tried for the last two years to build himself up, but his health is n't good. He is nervous and "cranky." To-day when we find him he has just had a violent set-to with the balance-of-stores clerk over an alleged discrepancy in his perpetual inventory figures on three-eighths inch hex nuts. His mind was occupied, at the time, with a telephone call from his wife. His wife said that the installment house men were calling to get the furniture. Grant told her to hold them off by giving them the rent money. She said that the landlord had just got the rent money ten minutes before. At this point the balance-of-stores clerk had entered and shouted, and, in good nature, but obvious contempt of the stores-keeper, said, "Grant, get off that 'phone, and tell me where the hell you get these figures on hex nuts!" Grant's nerves snapped. One thing led to another, and now the boss is on his way out to fire Grant, because he is really too erratic to keep on a responsible job like that. Meanwhile, it will be lucky for Grant if he does n't pull a box of pressure-gauges down onto his head. There! What did we tell you? Down it comes! When Grant revives, the doctor will put in seven stitches.

Let us now place ourselves at the head of the stairs going down to the girls' locker and rest-room. Millie Jones is on her way here. She is looking at nothing around her. Her thoughts are fixed on what happened last night. She is living, again, that moment in the dark, as her lover tells her that it is n't his fault what has happened. "You must have been going with some other man," he says. He pulls himself away from her grasp and leaves her alone on the bench in the park. The agonizing loneliness of this moment has fixed itself in Millie's mind, and all morning she has aimlessly fumbled over her work as an inspector till it is discovered that she is not stopping the bad ones. The fore-lady has just told her to go downstairs and rest up. As the girl approaches us, we can see that she is "ready to scream." Indeed, as she reaches the top of the stairs she becomes hysterical and takes a bad tumble. She will draw compensation for the fall, but the company will drop her from the pay-roll for having hysterics.

In the foundry division across the street we hunt up Millie's lover, Bob Mitchell, a time-keeper. As we come up to him, he seems to be sorting time tickets, and multiplying and extending figures. But his mind is n't on his work. A seething torment of fear and confusion has made a mess of his thoughts. He sees no easy way out of the situation which Millie put up to him last night. Last week he got himself engaged to another girl. Last night he tried to "break it off" with Millie and was told that there was an important obstacle. To-day he is trying to decide whether it is best to hasten or to postpone his marriage, whether to throw up his job, quit the whole situation, and go to another city, or *what* to do. Bob is n't on a kind of work in which there is an accident hazard, but his emotional situation is such that if he *were* in a dangerous job, in a short while he would very likely have something to take his mind off his troubles.

The chronic maladjustment. Our survey of the inner lives of these people need not be limited to temporary or acute emotional crises. We may note the chronic, brooding worries and troubles, the inescapable situations which gradually wear in on mental health.

Here is Joe Netarsky. His wife has been a nagging invalid for ten years. He has had no normal family life during all that time. His young sister-in-law has kept house for him. He secretly covets the girl because she is sweet-tempered and healthy. She, however, has a "steady," and every night slips out with her beau as soon as the dishes are done. Joe doesn't dare admit to himself what his real desires are, and he pretends to believe that his job as a sand-blaster is ruining his health. He broods over the boss's refusal to promote him to driving one of those electric trucks that go shooting through the plant. To him the electric truck has come to symbolize the unattainable. The forbidding boss has gradually come to stand in his mind as a persecutor. One day the boss will speak sharply to him, and Joe will retaliate by hurling a casting at him.

Stella Maguire is an old maid employed as a worker on a light-punch-press job. She has been tried on inspection and other work that brought her into close touch with other girls, but she was too quarrelsome to keep there. Stella is a man-hater, but, oddly enough, gets on better in the shop — possibly because the work itself isolates her. Her real trouble originally was her red hair, which brought her ridicule. An unrequited love affair seemed to her to owe its unhappiness to her silly hair. So she darkened it, but it kept growing out red, and at last she left it so, half red, half brown, and told the world to go hang. She has a delusion that a rich uncle will some day die and leave her tremendously wealthy. No one ever saw the rich uncle and her fellow workers have good reason to doubt his existence. Stella is usually excited and irritable, but she often slips into a day-dream about the uncle. Twice in the past year she has hurt her hand in the press. No one guessed that the reason for it was her complete mental abstraction at the time, so she is kept on the work quite as if she were safe to trust there.

Cases like Stella's are close to the border-line of insanity. And, indeed, many people who, if examined by experts, would be pronounced mental cases calling for asylum care, are for want of such examination permitted to blunder their way through the world without proper treatment and guidance. Industrial pursuits are burdened with them. Employers and fellow workers recognize them as "queer" or quarrelsome or stupid, but not as insane. In any typical factory or mill a survey such as we have here pretended to take would astonish the employers, if the real mental and emotional conditions of the workers could be revealed.

We are accustomed to think of insanity as a condition of total want of sense and control. We imagine it in terms of maniacal outbursts, screaming tantrums, and unintelligible gibberish. If a person is crazy, he is crazy, and that's an end of it. He goes "nutty" all at once, we assume. He is discovered in a raving condition, quickly captured by six strong men, and sent to an asylum. There he is put into a strait-jacket and fed through the nose. The public, indeed, has no patience for any other kind of insanity. When a man goes mad, it wants to see him crazy; it expects him to put up a show.

This public attitude grows out of the belief that the mind is all of one character — a single unified thing like a barrel of apples. It is familiarly referred to as "the inside of your head." Anything that goes into it is supposed to be added to what is already there, like a dipper of hot water poured into a bath. It is recognized that different heads have different qualities — various grades of gray matter in them; but it is generally assumed that the gray matter of any given person's head is the same, front and back, from side to side, and from top to bottom. When it goes bad, it goes that way altogether. If a mind is "off" in one matter, we feel it can't be trusted in any. To the casual notion the mind is a cavern of ideas. It is like a telephone; a thing with talk inside of it. It may get out of order, but, if it does, it can't be used at all. So long as it works, it is all right.

As a matter of fact, however, the mind is a vastly more complex thing than this. It may, of course, go bad through and through as the public likes to assume. A general physical decay and disease will bring this about. But it more often simply weakens or fails to work properly in some one department. We might reasonably compare the mind to an orchestra, which depends for its harmonious effects upon a group of independently operated instruments. Any one horn or woodwind may be badly played, or any one violin out of tune, and the effect is noticeable only when the music calls the faulty player into prominence. Or the conductor himself and his entire ensemble may be as poor as a village band practicing on "The Holy City." Almost anything may be wrong with an orchestra, part or whole. And so with a mind. It is a complex, built-up structure, depending for its efficiency on bodily health, on the secretions of the ductless glands, on hereditary tendencies, and on accumulated relationships with the environment. The lifetime experiences are recorded in the brain in what are known as the "action-patterns" — habitual ways of thinking and responding. It is easy to believe that some action-patterns may be useful and normal, and others quite defective — insane. There are all grades and varieties of mental disease. There are the minor moods and distempers, the false conceptions, beliefs, and delusions from which we all suffer, and, in calmer moments, recognize for what they are. They grade up to the permanent derangements which wholly disqualify for ordinary pursuits. In between, there are grades of disease which experts will pronounce insanity, but which often escape detection for years.

This is due not alone to the fact that insanity generally begins mildly and intermittently, but also that it often touches only a small portion of the mental life — and not necessarily an important section. It may be a simple delusion or an hallucination harbored as a kind of extra character in a play, a grotesque figure rarely seen or heard, who takes no necessary part in the performance. The plot unfolds without him and the other characters may ignore him. Or it may be that the insanity merely exaggerates or plays tricks with the emotions, so that they cease to bear a normal relationship to current experience. When this is so, it is clear that it requires a fairly close observation of the deranged person to discover how far his feelings are irrelevant. We generally assume that a man is his own best judge of what should trouble him.

Thus, we find that the great majority of mental cases require close study for accurate diagnosis. And thus it becomes possible for insane people to move about, pursue a more or less free but usually unhappy existence, and so find their way into industry. The late Dr. E. E. Southerd, a great specialist in mental diseases, and head of the Boston Psychopathic Hospital, said: "Insanity cannot be defined." For this reason, in many cases, it is not even suspected.

The psychology of insanity. A common form of insanity is syphilitic — paresis — which furnishes 9 to 11 per cent of the cases. It usually escapes detection in the early stages. Even a superficial physical examination may not establish a diagnosis. It begins to manifest itself by a lack of punctuality, lack of arithmetical ability, mistakes in direction, "nerves," irritability, and occasional lapses of consciousness. None of these things alone would mark the victim at once as insane.

Another common form of insanity — dementia præcox — generally fools the casual observer. The sufferer appears to know where and who he is; his memory is not noticeably faulty and general knowledge is retained in the early stages. Hallucination, over-suggestibility, over-activity, and wandering attention may mark the disquieted mind, but few laymen can read the signs.

The paranoiac, another type of victim, may have delusions of persecution, but he is often able to persuade people that he really is a victim of conspiracy or spite. His ordinary conduct may, indeed, appear quite sane.

The manic-depressive type of insanity is a derangement of the emotions which offers no purely mental signs whatever. Indeed, these and most of the other cases are so near normal in their outward appearance that one might well wonder why it is necessary to diagnose and study them at all. The reason for doing so is twofold. In the first place, insanity tends to grow worse and more settled. The earlier it is detected, the better the chance of effecting an improvement or cure. In the second place, while the ordinary appearance, conduct, and ideas of the insane may be normal, there may be a lurking phase which makes him dangerous to himself or to fellow workers. All of us do strange and unaccountable things at times; the demented person does them more frequently and more unaccountably.

The particular danger of obscure forms of insanity as well as of emotional disturbances of every kind, from the point of view of accidents, is the fact that there is always some aspect of inverted attention, or preoccupation. An entirely normal person always reacts to what is going on about him. He listens when he hears a noise and jumps when surprised by something he does n't understand. He speaks when he is spoken to and "talks sense" in reply. The deranged person always has some persistent idea, however, to which his mind must give heed, at all costs. With one, it is a dissociation of personality which "takes him out of himself," making him actually live over an emotional situation which occurred in a time gone by or in another place. With another, it may be an hallucination — the belief that he hears strange voices or sees things to which others are oblivious. The watchman who mutters and talks to himself may be carrying on conversation with the President of the United States, with the firm conviction of his actual presence. The sweeper or window-washer who silently moves about the plant may be harboring the delusion that he owns a mortgage on the factory, which he is about to foreclose.

The brooding, the day-dreaming, the persistent worry of the normal person possessed by some grief or problem may fix his attention on a matter outside of himself and so dull his response to his environment. In such case the proof of still remaining normal lies in the ability frankly to face his difficulty and deal with it for what it is. In many cases, however, there is a substitution of ideas. Originally, in the attempt to escape from a home worry, a sex problem, a fear, or a sense of inadequacy, the unhappy mind turns to some fanciful counteractive. The homely girl, for instance, starved for love and admiration, pictures herself as Cinderella, suddenly made lovely and rich. In course of time any occasion likely to call to mind her true situation automatically turns her thought to her dream, which became a fixed delusion. Another person might find escape from a troublesome situation by blaming some one outside of himself, and so build up a delusion of persecution. When these changes come, insanity, in some degree, has come.

The escape from a troublesome situation does not usually take the form of a substitution of ideas. There must *always* be some escape, however. The mind *will* not contemplate unhappy images and situations unmoved. The very capacity to suffer is a guarantee of a reaction of some character. Dull wits or deadened senses may not react further — but if they do not, at least they *have* reacted; if normal responses are no longer given to a stimulus, the apathy itself is a form of insanity. Normally we weep when we are grieved, laugh when we are merry, fight when we are angry, and, in a state of untrammeled nature, we make brazen and unblushing advances to the lady of our choice when we fall in love. Civilized life being an organized conspiracy to thwart and inhibit the natural expression of our emotions and desires, however, we may have to choose various alternative modes of response. A substitution of ideas may result in insanity. A "sublimation" of impulses — which is the more normal and healthy outlet — is the release of energies and emotions through athletics, play, artistic endeavor, or religious or social work. Another form of outlet is destructive action — horseplay, malicious mischief, or crime. Thievery in children, for instance, has sometimes been traced back to some conflict of sex ideas.

This all sounds very simple. It is another way of saying that all forms of mental or emotional disturbance have a similar causation. It grows out of a theory which regards exaggerated ambition, excessive altruistic endeavor, destructive or criminal acts, and all the various stages of mental disease — including downright insanity — all as indirect outlets for emotional impulses which are denied immediate expression. It is not difficult so to understand them, and yet, with respect to insanity, the conception is very new, and not yet universally accepted by psychiatrists. Till very recently, insanity, where it was not identified with physical brain decay, has been regarded as unexplainable. To speak of the "psychology of insanity" would have been regarded as absurd. It is, therefore, very comforting to be able to bring all forms of mental disturbance under one general explanation. It gives hope that a more thorough study of puzzling cases of insanity will always reveal at the roots a reasonable cause, and the hope, also, that means of prevention or cure of a portion of such cases will be found.

Prevention would take the course of either providing mental outlets for the emotional energies, or by early education, discipline, recreation, etc., providing adequate substitutes for, or checks on, the primal impulses. Cure would take the course of analyzing a mental disturbance back to its original cause, and, if possible, removing or mitigating the cause, and leading the mind forward again from the new basis. Such prevention and cure are called "mental hygiene," and it will have a legitimate place in industry in the future, if only for the sake of reducing unhappiness and increasing working efficiency.[1]

[1] See the author's paper, *Has Mental Hygiene a Practical Use in Industry?* which may be obtained from the National

It will probably also prove to be a factor in reducing accidents. The examples given at the beginning of this chapter lend some color to the belief that emotional disturbance distracts the mind from the business in hand, and that accidents happen more easily to a mind obsessed by trouble.

Committee for Mental Hygiene, 370 Seventh Avenue, New York, or the Massachusetts Society for Mental Hygiene, 18 Tremont Street, Boston. Excellent papers on mental hygiene in industry have been published by these societies.

CHAPTER VIII

THE PHYSICAL MIND

Body and mind. A text on psychology[1] which I picked up the other day makes no mention of the mind! The Greek source of the word "psychology," which is used in the title, does, of course, mean "discourse about the mind." But aside from this remote allusion to the mental machinery, the author — a recognized authority on the subject — so far as I can discover, does not speak of the mind.

He calls attention, himself, to the fact that he "makes no reference to consciousness, sensation, perception, attention, will, image, and the like." He says that not only can he get along without them, but that frankly he does n't even know what they mean. "I have retained such terms as thinking and memory, but I have carefully redefined them," says this extremely modern expositor of human behavior.

[1] John B. Watson, *Psychology from the Standpoint of a Behaviorist.* Philadelphia, 1919.

MENTAL CAUSES OF ACCIDENTS

Those of us who studied psychology when it did treat of the mind, and read authors who thought they did know what *consciousness* and *will* and *image* meant, are a bit handicapped for understanding Professor Watson. But if we can put aside our prejudices, we shall be interested to discover that almost all recent psychologists make no positive distinction between the body and the mind. In writing on these subjects they reveal little difference between physiology and psychology. The former is conceived of as dealing with bodily organs and functions individually, without regard to their response to the general environment. The new psychology deals with these same bodily organs and functions as a whole, and with their response to the outer situation.

The modern view begs the question as to whether the mind is anything more than the sum total of the functions of the body. But it certainly regards the mind as including the body. For instance, a loss of a hand would be the loss of a part of the mind. Does this sound reasonable? If you have dealt with accident cases, you may dispute this. You remember poor old Mike Karaganovitch, who stuck his hand in the gears and drew it out so mutilated that it had to be cut off at the wrist. And for several weeks afterward Mike complained of pain in the fingers of the amputated hand. Surely, all that his hand had ever been to his mind was still there, troubling him!

The "behaviorist" psychologist, however, would not be at a loss to explain this oddity as the dying reactions of severed nerves that formerly extended to and from the fingers and that will soon cease to carry any impression to the brain. A certain area of the brain ceases to function after the loss of the hand, save perhaps as memory.

But if loss of an organ is loss of part of the mind, so disease in any organ must be regarded as an infirmity of the mind. Changes in physical states will be regarded as being accompanied by changes in mental states. A lowered vitality will be paralleled by a lowered mentality. If mind and body are just two views of the same thing, inability to react promptly in a physical way will be accompanied or caused by a sluggishness in the brain.

It is worth while to consider how far the facts about disease bear out this theory. If it is true, of course we shall need to watch very carefully the physical condition of the workers. It will not be sufficient to hire those who are fit, and assign them to tasks in proportion to their strength. It will also be necessary to watch the changes in their physical condition. A man who is just capable mentally of handling a dangerous process while in the pink of health will become a menace should he become depressed and ill.

Apparent exceptions to this line of reasoning will, of course, at once spring to mind. I can, myself, cite a case that seems to challenge the theory that the mind exists only through the body. A classmate in high school dove in shallow water and broke his neck. He was not killed, but paralyzed. For six years he lay helpless, unable to feed himself or perform any other bodily activity unaided. Nevertheless, his intelligence appeared to be in no wise damaged. Indeed, his cheerfulness, his wit, his sound reasoning on politics and other social questions, his interest in good books and good music, all increased. He was such pleasant company that, not because they pitied him chiefly, but because they profited by knowing him, constant streams of visitors from every station of life sought his lively companionship.

Such a case seems to belie the assertion that an injury to the body is an injury to a part of the mind. Upon reflection, however, we must admit that it is a deceptive case, because paralysis due to pressure upon the spinal cord may interfere with only a small portion of the mind and body. In this case it blocked the control only of a portion of the voluntary muscles. The great nerve centers, which are the larger part of the mind, namely, the solar plexus and the other centers controlling involuntary muscles and participating in the control of the digestion, the respiration, circulation, etc., were all unaffected. From the point of view of functions, this boy's injury was very slight. He could not move about, but his body was not sick in any other way. In the course of time, lack of exercise and lack of control over the eliminative functions impaired his general health, and with that change his mental efficiency did suffer.

Such a case, therefore, when studied, presents no exception to the probable fact that every injury which permits the mind to function without apparent loss of power will prove to be local. The mere loss of a mechanical function or member is not to be confused with an impairment of vital function, which we know as disease.

The human body is such a highly organized and versatile aggregation that the loss of a single member, or even of a single sense, does not greatly impair the physical efficiency. We should not, therefore, expect impairment to produce larger consequences in the mind. Helen Keller is deaf and blind, and yet she is able to appreciate art and music, to address audiences in a clearly intelligible voice, and convey intelligent ideas about politics. With her finger-tips on the sound box of a violin she can thrill with pleasure to the playing of a Kreisler, and, lightly running her delicate hands over the surface of a piece of sculpture, she can appreciate the beauties of idea, form, and modeling which the artist has imparted to it. At first thought, her mind might seem to be whole, and unimpaired by her physical deficiencies. Many would stoutly argue, indeed, that it is absurd to compare her intelligence unfavorably with that of a fully endowed organism. It seems to be a denial of the power of soul to confine it to what the poor body is able to perform. None of us can quite escape this sentiment, for it is not alone founded in our ingrained religious prejudices, but also inherent in our natural assumptions about our minds which we form through introspection.

When we look into our own minds, we are first aware of consciousness, and this we take to *be* our mind. But consciousness is only an infinitely small part of the sentient organism. Only a portion of the mind is conscious at any one time. When we are "carried away," for instance, by music, we are using chiefly our sense of hearing and that portion of the brain which has stored up music patterns. Sight, and the other senses, memories of other days, even the feeling of who we are and what our present situation is, may be for the moment wholly "out of mind" without our consciousness being any the less acute. When we forget, we simply put a known thing out of consciousness. When we remember, we call it into consciousness again at the end of a chain of associated impressions.

We hear with a *part* of the mind, we see with a *part* of the mind, we feel with a *part* of the mind, and so on. It is not alone impossible for all the mind to be active at once, but if it were, it would be a bedlam of conflicting emotions and impressions. A three-ringed circus and a Battle of Gettysburg rolled into one would engage but a corner of the available stage.

When a blind man listens to a performance of Beethoven's Fifth Symphony, therefore, he is employing as large a portion of his mind as we could possibly use for the same purpose. When Helen Keller runs her finger-tips over the features of a child asleep, she receives an impression as satisfying and as complete as the watchful mother might in the circumstances. The loving touch disdains the coldness of mere sight. Those who suffer from the loss of faculties do not feel any loss of consciousness. Their limitations merely require them to rely more constantly upon what senses they have left. And in the more frequent exercise of the remaining capacities and closer attention to distinctions in those senses, they seem to develop a special acuity and fineness in them. A deaf man compensates, in part, by cultivating a keener response to vision, and a more delicate touch. The blind man seems to hear with the rabbit and to scent with the hound. The human body has reserves of strength and the various portions of the mind have unused resources which are rarely called into full activity. A misfortune in the loss of one sense or limb, therefore, often produces a corresponding offset in the development of others, and cases are not rare where the greater concentration upon some highly perfected ability thus secured has proved to the advantage of the person afflicted. A starfish deprived of one of his tentacles feels the loss so keenly that he perforce must grow another or lose out in competition. In doing so he sometimes replaces the missing one with two new ones. A lizard can replace a severed tail.

Some of the lower animals can even duplicate sense organs. But man, with a more varied equipment, is able to abandon a lost member. He does grow a second, and sometimes a third set of teeth, but otherwise he merely cuts an impaired organ or faculty out of his repertoire for good, and draws on his abundant reserves.

No one will care to assert, however, that the compensation is ever complete. A better use of vision will not altogether console for deafness and a more sensitive touch will not repair all of the damage of lost eyesight. So far as the body is minimized by impairment, compensations being allowed for, by so much is the mind restricted. Enjoyment and understanding of what remains may be keener than ever, but intelligence must necessarily range over a more limited field. The fact that consciousness plays with full publicity, so to speak, upon whatever is being performed in the mind at any given time, serves to disguise the loss of any portion of the great unseen, unconscious areas.

But, aside from the range of things which the mind has to bring into consciousness, it is subject to variations in two other respects, in which it depends upon the physical equipment. In the first place, the quality of feeling of consciousness may alter, and in the second place, the vividness or acuteness of consciousness may fluctuate. The first difference seems to depend in part upon the composition of the blood, which carries at different times different chemical elements. The second difference depends upon the quantity of the blood furnished to the organs. Reduced blood supply in an organ diminishes function and sensation. Reduced blood supply in the brain diminishes consciousness. The fact that the quantity of blood in the brain is greatly reduced during normal sleep may be checked by observing an infant asleep. Not only does the color somewhat leave the cheeks, but the fontanelle — the soft circle in the skull — which in waking hours is slightly distended with the pulse of blood, becomes depressed with the lapse of consciousness.

Disease and efficiency. From these facts it becomes clearer why an illness which reduces the quantity of the blood which reaches the brain, or which disturbs the chemical composition of the blood stream, carries with it mental effects which are general and obvious. Not only is the mind less resourceful — as in the case of the loss of an organ — but in the case of illness it is likely to be less happy, and less "awake." The mental operations are subject to other influences than the usual processes of suggestion and stimulus, and cannot be depended upon for normal work.

The successful careers of such men as Robert Louis Stevenson and Charles Darwin, known to have suffered from wretched ill-health most of their lives, are sometimes referred to for proof of the superiority of the mind to the trammels of the body. A close examination of the circumstances in which they did their work, however, greatly alters the force of the argument. Stevenson, for instance, adopted literature as a life-work after he had been compelled by his recurring illness to give up engineering. Desultory literary composition permitted him to pursue good health in whatever climate suited him, and to do bits of writing on days when he felt exuberant. He began his work when he was about twenty-five, and it was ten years before he was able to support himself by his writing, and not until he was thirty-seven did he begin to earn a good living at writing. Although constitutionally weak, he was by no means always ill. His lungs failed him many times, but he shook off disease till well after he began to write. During the first four years of his work, while he was in France, his health was "very passable," and he did likewise very passable work — "Virginibus Puerisque," "New Arabian Nights," "Travels with a Donkey," and "An Inland Voyage." For one period of six years he did not have to spend any period of twenty-four hours together in bed.

His letters throughout his lifetime are full of references to spurts of productivity during which he was happy and well, following barren weeks of suffering. "My health has turned a corner," he writes. Or, "He kept in the meantime a fair level of health," says his friend, Sidney Colvin.

Nor was his disease — tuberculosis — always devastating in its physical effects. "My sufferings have been healthier than his. [Comment-ing on a "feverish" friend.] Mine have always been a choice where a man could be manly."

But when he was actually at grips with influenza, or ague fever, or hemorrhages, his work fell off, either in quality or in output altogether. The pathos of Stevenson's letters is the evidence of his not always successful efforts to ignore the checks and restraints which his physical sufferings put upon his intellectual efforts.

"As for my poor literature, dear Henley [Dec. 11, '78], you must expect for a time to find it worse and worse. Perhaps, if God favors me a little at last, it will pick up again. Now I am fighting, with both hands, a hard battle, and my work, while as successful as I can make it, will probably be worth two-pence."

Again he wrote: "Here 's December gone, useless. I have no style to command for the moment."

In all but one period, his work was produced in times of fairly robust health. During one summer in Scotland, when he felt well enough to try for a professorship (which, fortunately, he did not get), he produced much of "A Child's Garden of Verses," "The Merry Men," and half of "Treasure Island." It is true that at Bournemouth, England, when for three years he was mostly in bed, he also wrote "Kidnapped," "Dr. Jekyll and Mr. Hyde," and other notable pieces. But it was only by the careful husbanding of his strength, which kept him even from talking above a whisper, that he was able to produce at all. At other times, when his health was poor, as during seven months at Saranac, New York, he wrote practically nothing. And in the last two years of his short life, illness so diminished the quality and so delayed the schedule of his writing as to cause him anxiety with regard to his income.

Darwin, too, was able to produce, not so much in spite of ill-health, as out of a very carefully preserved but very narrow margin of good health. His son wrote that "for nearly forty years he never knew one day of the health of ordinary men." In view of this statement his respectably large production of scientific notes and writings may seem surprising. We have to observe, however, that, while ill-health kept him from working more than three hours a day, he did secure that much time unfailingly. His father's wealth had prevented his ever having to work for a living. His physical condition prevented his wasting his efforts, so that he rarely went out. He seldom met and scarcely knew the scientific men of his day. His loyal and most devoted wife, who in his later years never spent a night away from home, preserved his life from anxieties and his programme from interruptions. His hours of production, therefore, far exceeded the time which other scientists are able to allot to similar work, when they are obliged to support themselves by lecturing in colleges, interviewing students, attending society meetings, and sweating over miscellaneous paper-work.

Darwin, furthermore, was far from being an invalid. His daily programme, besides writing, included walking, games of backgammon, and other pastimes which suggest that his whole life was one of cheerful convalescence.

I am led rather to conclude, indeed, that ill-health in the cases of Stevenson and Darwin helped their careers by holding them to the work in which they made their fame, but that, if their maladies had been less benign, their work would have had a different fate.

For other, more acute or more deadly, diseases have more pronounced effects. The mental phases of many common ailments are so erratic that it is proper to study and treat them under the headings of mental diseases. In uræmia — that is, the failure of kidney function — the mental effects, aside from blurred vision, may be confusion, illusion or hallucination, anxiety and depression.

In hyperthyroidism, or excess of the secretion of the thyroid gland (exophthalmic goitre), which is very common, there are emotional disturbances, irritability, loss of control, excitement, and tendency to anger on slight provocation. In myxœdemia, on the other hand, which is due to thyroid *deficiency*, there is an impairment of the mental functions, dullness and depression.

Diabetes may produce mental effects of irritability, suspicion, even delusions. Gout, as is well known wherever gout is well known, tends to make the victim irascible. And the effects of typhoid fever or pneumonia so often include mental prostration, delusions, ravings, and hallucinations that these mental phases of the diseases do not excite surprise when they occur.

By far the larger number of cases of depression from illness are temporary or intermittent in their effects. Gastro-intestinal disorders in their various aspects may result in auto-intoxication, which is just another name for "feeling rotten" or "thick-headed." Only those who have suffered the periodic ravages of sick headaches can understand the mental desolation, the sensation of system poisoning, which they produce. Yet the sad part of many of these troubles is that they do not put the victim down and out and send him to bed, where he would be at least safe from accident, but seem to require him to bear up bravely and go through his regular tasks. The results are often very costly.

Under-nourishment alone, without any complications of disease, may be a cause of inefficiency, and by inference, a predisposition to accident. An experiment in giving extra nourishment to girl factory workers who were under weight, and otherwise apparently under-nourished, resulted, in a twelve weeks' experiment, in improvement in general health in 90 per cent of the cases. There was a general increase in weight. In the group whose production efficiency could be measured, twenty-two gained in production, seven showed no change, and five lost. "In two instances the gain in efficiency was such that it made the worker the best in her department."[1]

How we injure our own health. It should not be forgotten that exhaustion or low vitality as the result of excesses, drinking, etc., produce mental defects that are hazardous. The term "hang-over" is descriptive of a mental state as a result of drinking. Physiologists declare that it is possible to measure in terms of mental and physical work the loss of efficiency which results the following day from drinking a single glass of wine or alcohol. It is possible that heavy drinkers compensate a little on these effects, but, certainly, exhaustion from exces-

[1] William Hall Bunn, M.D., "Studies in Undernourishment in Industry–I," *Journal of Industrial Hygiene*, July, 1922.

sive drinking is as much a mental as a physical condition.

The Harrison Drug Law has perhaps diminished the number of people addicted to the habit-forming drugs, such as opiates and cocaine, which may now be got only on prescription; but people still will dose themselves with whatever they can buy. Many come to depend upon aspirin and other coal-tar drugs, and the increase in the rate of use of them suggests that here is another group of drugs which may ultimately go under the ban. In some of the Southern mills the number of people who drink "dope" beverages to excess on account of their drug content is astonishing. The concoctions which now pass for whiskey and beer should perhaps be considered under the head of drugs rather than of alcohol. It is certain that, in some industrial communities, the net effect of "hooch" is nearly as harmful as licensed drinking used to be.

There are even those who assert that smoking is harmful. Professional men have often found inordinate smoking to have a depressing effect and gained a mental lift by giving it up all together. Men of certain temperaments are perhaps well advised to avoid tobacco. On the other hand, scientific investigation has not proved that, in general, tobacco-smoking is harmful. Indeed, some evidence is more than negative. For instance, in "Industrial Hygiene" for May, 1921, it is reported that among five hundred glassblowers the light smokers produced less per man than the heavy smokers.

Plant conditions and depression. Everything which we have cited up to this point on the mental effects of physical depression has had to do with individual cases. It is interesting to note what proof has been found that general conditions affecting groups of people in factories or in larger communities influence the health, and in turn the mental output of the whole groups. Professor Ellsworth Huntington,[1] of Yale, has traced between the period of 1890 and 1910 the relation between health and the intelligence of the whole community. He compares the number of persons successfully passing the civil service examinations with the

[1] *World Power and Evolution.* New Haven, 1920.

rise and fall of the death-rate in the country. In the years which indicate by their increased death-rate that conditions were not favorable to good health, there was a smaller number of people able successfully to pass the examinations. When health seemed to improve, a larger number of people went on the eligible list.

Apparently the greatest single influence on the general health is the matter of climate. Those sections of the world which are considered as being most favored in terms of climate have been mapped out. The sections in which intelligence is most active, namely, Eastern Central United States and Western and Northern Europe, are found to have similar climatic conditions. Not those portions of the world which have the most delightful climates are the most beneficial. For instance, the Bahama Islands have too equable a weather situation. The people themselves recognize that they are more inclined to be lazy and inactive than dwellers in a more bracing climate. Some Bahama parents send their children away to the United States or England to live because they recognize that the balmiest climate is not favorable to mental activity.

Apparently the desirable climate is one that does not go to violent extremes of cold or heat, but which nevertheless varies markedly. As Professor Huntington sets it forth, the requirements of the best climate are cool, but not cold, winters, and warm, but not hot, summers; a fairly high humidity except in the warm seasons; frequent changes in weather. He cites the fact that wet Januarys show a lower death-rate than dry; that "cold-snaps" in the winter, because they are changes, are helpful. The marked increase in the winter death-rate, which is noted in every chart, is due, not to the conditions of outdoor weather so much as to the faulty conditions that man brings about indoors, as a result of the fact that it is cold outside.

To make this latter point clearer; if we believe the experts in ventilation, in what they say about the requirements of good atmospheric conditions and the effects that bad ventilation have upon human efficiency and health, we have apparently been making some fundamental mistakes in the management of our ventilation. We used to think that good ventilation was a matter of oxygen supply. We knew that we breathe air for the purpose of getting oxygen to burn in our tissues and breathe out a waste gas known as carbon dioxide. We thought, therefore, that we had good ventilation when we replenished the supply of oxygen and turned out the carbon dioxide. Now, however, we know that good ventilation is hardly a chemical matter at all, but chiefly a mechanical affair. Almost any air has a much larger quantity of oxygen in it than we shall ever need and a much smaller quantity of carbon dioxide than will ever prove harmful. The reason why men suffer from such "close" air as we find in the turret of a battleship or in a submarine is the fact that the air is either too hot or too dry or too still. The oxygen in such a place is sufficient. Indeed, there could, theoretically, be too much oxygen. An atmosphere of 100 per cent oxygen would be unsuitable to man's requirements because a certain amount of other gases are necessary to stimulate respiration. Normal air contains 21 per cent oxygen, but man does not become uncomfortable until the oxygen drops to 10 per cent. A candle goes out at 15 per cent, so that we see, if a candle will burn in a room, man has a comfortable amount of oxygen. Furthermore, it takes more than one hundred times as much carbon dioxide as the air normally contains, to kill a man.

The principal defect of most ventilation is the fact that the air is too dry. Cold air contains less moisture than hot. In winter, therefore, the air outside is normally drier than in summer, but we take outside air into a room and heat it up to more than summer temperature, with the result that it is relatively still drier. Air, which should contain for our best health 75 per cent of such moisture as it can carry, is usually found in the winter to contain only 10 to 20 per cent. This is as dry as a desert, and the results are colds, dry, chapped skin, nervousness, and apparent fatigue.

Dry air chills us more easily than moist air; therefore, in these circumstances we have to heat our rooms to a degree which is not conducive to the best health. The temperature should be around 65° in air properly moist. Dry, it has to be above 70° to feel comfortable. Proper atmospheric conditions also depend upon the air's being somewhat in motion, and a proper stimulation to the pores of the skin requires variation in temperature from time to time.

When the usual faulty conditions obtain, a positive loss in mental efficiency results, and when they are remedied, the mind itself, as well as the body, works most satisfactorily.

C. S. Myers, in his book on "Mind and Work,"[1] quotes the results on experiments upon animals and their ability to work at different temperatures and at different relative humidities. Counting the work done at 69° F. and 52 per cent relative humidity as 100 units, it was found that at the less desirable temperature of 75° with a relative humidity of 70 per cent, 85 units of work were accomplished. At the still more undesirable temperature of 91° with a relative humidity of 90 per cent, only 76 units of work were accomplished. He also

[1] New York, 1921.

cites an investigation in a tinplate industry in which it was declared that, by improving ventilation, managers were able to secure 12 per cent more output.

Of course, it is not possible to tell how many accidents result from bad ventilation nor how many are prevented by improving it. Relative production is an indication, however, of mental efficiency.

We can get the same measure of the effect of good or poor illumination and draw inferences as to the accident hazard. When we learn, for instance, that by changing the illumination of a plant from 4000 to 12,000-foot candles, and by making no other change, production was increased from 8 to 27 per cent in various departments, we can surmise a corresponding mental change.

Indeed, the purely mental effects of different degrees of illumination have been studied by Martha Elliott. In terms of the variation in reaction times she shows that mental efficiency increases rapidly for each increase in illumination up to ten-foot candles, and more slowly beyond that. The variation between five and ten-foot candles is the ratio between 92 and 97.[1] The kind of light, too, affects speed of reaction times so that, at the ten-foot candles, the motions in unit-time possible under Cooper-Hewitt light will be 107 when under tungsten light of the same intensity only 97 motions are made. Where freedom from accident is just obtained by promptness of reaction, there is a certain range of cases in which an accident would happen at five candle-power of illumination, or under tungsten light, and would be avoided by more adequate lighting.

There is, however, a more direct connection between illumination and accidents. In the United States alone there are 15,000 deaths per year caused by falls. The connection between this and illumination is traced in the fact that there are in general 29 per cent more accidents at night than on day shifts and that there are 71 per cent more falls at night. S. C. Dorn, in "Nation's Health" for August 15, 1921, said that one insurance company, in an analysis of

[1] "Comparative Cognitive Reaction Time with Lights of Different Spectral Character and at Different Intensities of Illumination," *American Journal of Psychology*, January, 1922.

91,000 accidents, ascribed 15 per cent of them to poor lighting, and another company gave 23.8 per cent of the accidents as the result of faulty illumination.

The influence of illumination may not always be direct — through affecting the ability of the worker to see where he is going; it may also be indirect through its effects on the eyes. Glare will often produce a mental state unfavorable to work, or eye-strain may involve nervous tension which results in accident.

There are, of course, other physical conditions which produce somewhat the same effects and involve the same accident hazards that ventilation and illumination do. In one case, it may be lack of good drinking-water; in another, it may be simply the depressing effect of ugliness or noise; the lack of a decent place in which to eat. Some men, at least, are affected by such things.

Safety engineers, therefore, who desire to consider more than the mere mechanical aspects of accident prevention, will look first to the general matters of lighting, ventilation, and other plant conditions which affect the physical conditions of whole groups of workers. Beyond that, they will coöperate with the medical departments in dealing with individual illnesses on the ground that sick men are more likely to get hurt than the robust workers.

CHAPTER IX

THE TIRED MIND

Misleading statistics. Do weary, overworked men have more accidents than workmen who are fresh and "full of pep"? One wants to say yes. It is easy to believe that a tired mind is an absent mind, and therefore susceptible to accident. One wants to find figures to prove it; and, indeed, the persistent seeker can find them, if he uses judicious selection and will ignore contradictory material. Almost all tables showing the hours of the day on which accidents occur show a rising curve toward the end of morning and afternoon sessions. Surely there's ample proof that tired men get hurt!

But there are some questions in industry as well as in other fields where it is better to hang on to common-sense beliefs until we can be sure that apparent statistics really furnish the answers. I am told that, at the same time as the public-health work in the town of Brookline has improved, and that particularly while the efforts to reduce deaths of babies by maternity education, prenatal care, better milk supply, etc., have been redoubled, the infant mortality rate in that favored town has unexpectedly increased. If we were to be guided by statistics alone, we should be forced to give up all such public hygiene. But our common sense tells us that other factors in this situation are at work harder than the doctors, and that the statistics are influenced by some things that we have not taken account of. So it is with the figures on the relationship between fatigue and accidents. It has been possible to make up all sorts of tables for this relationship, but too many elements are elusive, and too many factors affect the results, to enable us to rely upon figures alone.

For some reputable accident figures do not exactly correspond to our feeling about the danger of fatigue. On the one hand, F. S. Lee, in a book on "The Human Machine and Industrial Efficiency," says: "Most of the tabulations that have been made agree in showing that as output diminishes in each spell, coincident with the progress of fatigue, accidents increase in number — the curve gradually rises through the spell." On the other hand, Dr. P. S. Florence has charted industrial accidents in certain factories for six months according to the hour of the day at which they occurred, and, while there was a rising curve of accidents both morning and afternoon, production did not fall off in the same way. The relation of the increase of accidents to fatigue was by no means made clear. Furthermore, at abulation by Dr. A. F. Stanley Kent, an English investigator, showed that accidents increased as production *increased* in the morning and that accidents still increased in the afternoon as production *decreased*. Where do such figures get us?

Some light on these inconclusive results is furnished by Dr. Bernard J. Newman, of the United States Public Health Service. He says that both accidents and production decrease at the very close of the day, and the decline in the accident rate does not keep pace with the decline of production. The number of accidents in proportion to the number of pieces produced is greater in the last hour than in the previous hours. Furthermore, Dr. Newman has collected figures which seem to show that piece-workers are more liable to accidents than those on day work, and inasmuch as piece-workers are presumed to extend themselves more, and sometimes greatly fatigue themselves, it is considered safe to say that such figures indicate a relation between fatigue and increased accidents.

For my own part, however, I prefer to treat skeptically all statistics in the matter of fatigue. What we begin to know about this subject from the point of view of physiology gives rise to a doubt whether the effects of fatigue would show up directly in figures. Indeed, I question whether true fatigue, chiefly, is involved in the tables usually published. In the first place, Lee and Florence and Kent seem to have assumed that decrease in production is proportional to accumulation of fatigue, and that increased production indicates freedom from fatigue. I am not so sure that output measures fatigue. It is not safe to assume in advance that, if the worker experiences a feeling of fatigue as the day wears on, it is due to the quantity of work he is turning out. It is not safe to assume, even, because the number of accidents increases, and the feeling of fatigue increases at the same time, as the day wears on, that, therefore, it is overwork which has produced weariness and accidents, in turn. All these perhaps surprising statements grow out of the peculiar nature of fatigue as revealed in the light of recent studies.

Before arguing anything about fatigue, therefore, let us make sure at the start that we have not been making false assumptions about it. We are likely to think of it as "that tired feeling." Now, while it is all right, in conversation, to refer to a feeling of weariness as fatigue, a physiologist is not able to get anywhere with that idea. He knows that "that tired feeling" may be most acute at the beginning of the spell of work, and wear away as one warms up. He knows, again, that a worker may have used up nearly all of his energy and be approaching the point of collapse — as many an oarsman in a boat-race — and still at the given moment be aware of no fatigue, and actually be producing at a high rate of efficiency. "That tired feeling," therefore, is no definition at all of fatigue.

Since it is usually work which results in that tired feeling, it is often assumed that expending a given number of foot-pounds of energy will produce it. But we cannot get very far with any discussion of fatigue which assumes that it is uniformly proportional to any given quantity of work. Two men of the same strength and general state of health will work at very different rates of speed at the same task and come through to the end of the day each in quite different condition, relative to reserve energy. One may produce little and feel quite done up at the end of the day; the other may produce much and maintain his rate of production to the close without excessive weariness. Again, the same man, doing the same task on two successive days, will vary markedly in his ability to produce and his ability to stand the strain of his job. Such facts are so obvious from our own experience that it will easily be admitted that fatigue has no direct relation to the quantity of work performed.

Begging the question as to how much work will produce fatigue, scientists are usually in accord in assuming that fatigue is indicated by a reduced capacity for further work, and *vice* *versa.* But we should not even be too hasty in calling fatigue a diminished power to produce work. We have to hedge that about with exceptions and reservations, too. We have all experienced the surprise of going home from our labors completely tired out and finding that we can play a game of baseball before dinner, or going out for the evening and dancing until midnight without any weariness to complain of. We may even have experienced the bracing effect upon our work, when, although we seem to be all wearied out, we hear some particularly good piece of news. And we have seen the immediately tiring effect of an unpleasant announcement. Dr. Walter Dill Scott has described the results of experiments with athletes on rowing machines who appear to be tired out by a given quantity of work, but who are able measurably to increase their efforts in response to the urgings of their coaches, stimulating them by mere word of mouth. We have seen how football teams may leave the field at the close of the first half, soundly whipped, having lost all of their gimp, only to come back the second half full of steam, when their coaches in the interval have berated them roundly.

Nor are these mental excitements the only means of dissipating fatigue. It is the practice in a good many factories to permit lunch carts to pass around the departments in the middle of the morning or the middle of the afternoon, because it has been found that a bite of lunch stays the flagging energies and produces increased output. It was the Yale football team which for a number of years issued sugar rations to its players because of the discovery that sugar very quickly gets into the energy-producing system. Of late years the Harvard team also has been issuing sugar rations to its players, and the results are said to be noticeable.

Tests with a machine known as an "ergograph," which measures the expenditure of energy in a selected muscle or set of muscles, reveal to us further reasons why it is not precisely correct to refer to fatigue as a diminished power to produce work. For instance, a man tested for how many times he can pull a certain weight with one finger may slow up or stop at a certain weight and then start out with a slightly lower weight apparently quite fresh.

After a time a certain weight may be found which he will be able to lift with the same finger for a practically indefinite time. Again, if the same weight be used, an interval of rest may enable the subject to resume work with the same vigor as before, and experiment will show that there is some length of rest period or some rate of recurring rest periods which will enable the subject to resume work at the same rate of output for a practically indefinite time. Experiments with excised muscles of frogs showed that power to contract will diminish after a certain time, but that if the waste products of the muscle — chiefly the lactic acid — which are produced as the result of the consumption of energy are washed away or neutralized chemically, the muscle is able to continue work for a far longer period.

Such examples as these indicate that it is not sufficient to define fatigue as a diminished power to produce work. That definition would lead us to assume that, whenever in any given circumstance such a diminished power showed up, we had a condition of fatigue, and that the only safe thing to do was to stop work. But our examples show us, on the other hand, that the amount of work that can be done in the first place depends upon the initial condition of the worker, and is affected beyond that by rest periods, by variation in the load, by nourishment, by elimination of waste products, and finally, and most important, by state of mind. We are not justified in practical conditions, then — particularly in industry, and more especially in our consideration of accident hazards — in calling either a feeling of weariness, or a low rate of output, fatigue. Statistics which are based on so superficial a view are valueless.

A serviceable description of fatigue would define it as a condition of weakness and torpor, accompanied by a feeling of lassitude, due to a general exhaustion of available bodily energy in the progress of exertion. Weariness that is due to ill-health or lack of normal energy, to begin with, is not fatigue, because there has been no exhaustion due to work. The fatigue of a single muscle by specialized work is, of course, possible, but unless general bodily energy is used up we should refer to muscle strain, for the breakdown of a single muscle must be distinguished, if only for common convenience, from a general condition of the whole system. Furthermore, apparent fatigue that may be overcome immediately by eating a lump of sugar, listening to a martial air, or hearing a phrase like "Beyond the Alps lies Italy!" is not to be called fatigue. If there is bodily energy which may be so easily tapped by turning on a new faucet, then we have not used up the available bodily energy.

We ought strictly to limit our use of the term to that complete exhaustion following exertion when all further normal stimulation is futile and only a new digestive cycle and a night's sleep will restore the energies. If we don't limit the term "fatigue" to this condition, which the working part of mankind has known so many million of evenings since the dawn of time, what name shall we find for that condition?

There is a fairly simple physiological explanation of fatigue. All bodily work is produced by contracting muscles. To contract at all, a muscle burns up its own tissue in the presence of oxygen taken from the blood. To continue the process of contraction, the waste products of the burning — chiefly lactic acid — must be eliminated, new tissue created, and new oxygen brought to the point of action. Blood must circulate to bring up food and oxygen and take away the lactic acid. The waste product, however, easily accumulates and soon poisons the nerves which give orders to the muscle. Usually, therefore, further muscular action is "inhibited"; that is, halted by a kind of nerve paralysis before the muscle is all used up. An increased supply of digested food, especially sugar, the greatest energy-producing material in the blood, will carry on the combustion and either overcome the inhibition or an increased circulation will carry away the excess lactic acid. This increased circulation can be secured by increasing mental excitement. The mental excitement produces its effects by causing the suprarenal glands to throw out into the blood a stimulant called "adrenin," which "increases the contraction of the small arteries, renders unusually forcible the heart beat, and consequently raises arterial pressure." [1] Anything

[1] Cannon, *Bodily Changes*, p. 95.

that excites the mind, whether pleasure or fear, joy or anger, music, noises, beauty or pain, will cause this stimulating effect.

Once the system becomes loaded up with the waste product of exertion, however, once the blood itself is clogged, the heart itself tired, the nervous system's capacity for excitement dulled, and the food supply exhausted, then we have a true condition of general fatigue, requiring a new cycle of digestion and elimination and a full night's rest, or even a vacation.

Energy blockade and industrial strain. With that picture in mind, can we justly say that the rising accident rate during the day is due to fatigue? If so, how does it happen that production so often also increases at the same time? And how does it happen that the worker is so often fresh for new tasks at the end of the day?

The truth is, when the workman thinks he is tired, the old man has a lot of life in him yet. The situation simply has n't been right to quicken him further. Indeed, what is there about the conditions of the average factory to make a fellow want to give his energy until it hurts? A woman may stand at a loom or behind a dry-goods counter perched up on high heels for eight hours in an unnatural strain, till she feels about ready to drop, but if she is at all healthy, she can dance the cramp out of her muscles in fifteen minutes after work. A machine tender may become so sick of his job that for a work-off he begins throwing monkey wrenches at his neighbor. (A certain proportion of our accidents — three per cent — in a group of eight mills is due to horseplay, growing, I think, out of boredom.) But, surely, such extra effort reveals a surplus of pent-up energy rather than over-exertion.

The tragedy and reproach of modern industry is that workers don't get fatigued enough. Of course we know of the exceptions. The steel workers at heavy, back-breaking labor, twelve hours a day, seven days a week, that Whiting Williams and Horace Drury write about; miners, picking coals in narrow seams while balanced upside down on the points of their Davy lamps; the ship's stokers and railroad firemen, the ditch-diggers, the caisson workers, many others, perhaps, experience that general, complete, and unshakable exhaustion at the end of the day's labor which, at best, only a good night's rest will overcome. I have seen the three-shift men of the Ford Motor Company of Detroit going home after a day's work on those endless chains of flivvers, and, of a whole greasy street-car load of them, not two of them but were sound asleep — done up. There's fatigue; perhaps unhealthy fatigue!

Even these Ford workers may have time to recuperate daily owing to the eight-hour day. It is a special case which we may leave in doubt here. There are other workers, however, who are also called upon to expend energy daily to the point of a general let-down, and the need of much food and sleep for recuperation, who, as a matter of common knowledge, nevertheless wax healthy. There's the farmhand, for instance. When he tucks himself into bed at night, he can barely remember the dawn when he set out on his rounds, shucking countless ears of corn for a drove of horses, feeding the hogs and milking the cows, by way of light chores before breakfast. He has walked behind the plough over acres of ground ninety-nine times, more or less, before noon, and as much more before supper. And yet, by means of taking in countless calories of food, and copious drafts of fresh air and spring water, he comes to the end of his day's labor, tired out, but capable of that marvelous, refreshing sleep which we all envy. The logger, swinging his axe all day long, like the Australian woodchoppers in the circus, may get good and ready for sleep as the result of his labors. And yet, through the winter he stores up energy, as he saves his money, at such a rate that he has to come to town in the spring for a "grand bust" to get rid of the surplus accumulation of both.

I have seen heavy iron molders whom I envied for their thundering hard labor. The way they come to toss about huge flasks and pound sand like drop forges; the way they handle big ladles of hot metal and knock heavy castings out of a mold, is fine to see. They are profane and dirty and stinking with sweat, but they ask no odds in a physical contest. No one who sees them gorging their noon lunch of a loaf of bread and a whole skin of bologna, no one who sees them piling rambunctiously into the locker-rooms at night like a crowd of boys, can worry very much about general fatigue as a problem of industry.

But, taking America's workers in the aggregate, trade by trade and occupation by occupation, the number whose work uses up daily the whole of their available energy-output is small. The number whose work cramps and thwarts them is far more numerous. The numbers who must repress and contain animal spirits and the impulse for physical effort while focusing on some trivial motions is appalling. Single operations — such as folding handkerchiefs, inspecting buttons, picking out knots in cloth, sewing on pockets, screwing in mainsprings in watches, wrapping up bars of soap, and the like, which constitute so large a proportion of the routine of factory work — cannot possibly give outlet to the energies that are crowding for expression in every normal person. Single muscles may be cramped or strained, particularly during the learning period, but such unbalanced muscle demands do not produce genuine fatigue. Or the worker may be required to misapply part of his energy in "defense reactions," as in the case of girls perched on unscientific stools, and wasting efforts to keep their balance or find a bearable posture by constant shift of position. But local weariness from such efforts is not fatigue.

Any one has a right to say that he is tired and be the judge of whether he is telling the truth or not. But when he says he is "fatigued," he is using a term that belongs to those with special knowledge. The little office girl pounding the typewriter all day long may feel tired, but she is probably not fatigued; on the contrary, she may be suffering from too little normal energy consumption. Her impulses sometimes find outlet in unpleasant or wasteful ways — quarreling, "dolling up," dawdling over her work, or spending too many evenings at the dance halls. But at least in such ways she may remain healthy.

If she is more conscientious, however, and applies herself diligently to her work during the day and spends her evenings quietly at home, she may develop insomnia, nervous troubles, indigestion, even tuberculosis, as the result of not having the type of work which induces daily a normal general fatigue.

The average factory worker is not a farmer, a logger, or an iron molder, but something more like a cross-legged needle-worker, moving his fingers from here to here, hour by hour, and straining his eyes over invisible stitches. The physical result of his work is not fatigue, but strain and ill-health. Through the day his energies are used up in the internal combustion of emotionalism, indigestion, and nervous twitching; through the years his cheated muscles atrophy and his vital organs gradually lose their power to generate energy. He becomes sluggish, depressed, stupid, old. He tires at slight exertion, and his day's work may, after a time, actually fatigue him, because he may generate so little energy that even his slight exertions exhaust the daily supply. But he tires as a sick man tires, and we are not well advised to consider his as a condition of fatigue, but of anæmia.

Nearly ninety per cent of the illnesses among factory people, as shown by many figures in my possession, are due to indigestion, infections of the nose and throat, and other troubles due to too little physical activity. Sluggish circulation, dissipating energies, and comparative over-eating, are the causes. Many a worker never develops a good natural hunger from one year's end to another. Most of them have to wait till dog-days before getting up a "good sweat." The Life Extension Institute reports that, while the great plagues such as tuberculosis, smallpox, and yellow fever are being overcome, the so-called "degenerative" diseases, due to defective organs, heart, stomach, and lungs, are greatly increasing. Our sedentary, monotonous industrial life seems to be largely to blame.

It is obvious from these considerations that something more than heavy labor is involved in the problem of so-called "fatigue." Indeed, the real evil of monotonous factory work is so obscure, so vaguely understood, that no satisfactory name for it has been found. "Strain," "brain-fag," "nerves," "auto-intoxication," are terms that describe phases of it, but none of them clearly denotes the condition.

There has been, so far as I know, no adequate explanation by laboratory science for the discomfort which comes from failure to use up available energy. It cannot properly be called fatigue, as we have seen. But it *feels* like fatigue, and the apparent symptoms of weakness and inertia cause it to *look* like fatigue. So, in spite of the modern view that there can be no purely mental ailment, that all mental behavior is really a form of physical behavior, many scientific workers speak of "mental fatigue."

A theory which seems to accord with experience is that, just as the vital processes of digestion and assimilation of food, breathing, heat production, etc., go on without cessation throughout lifetime, there is perhaps always some consumption of muscular tissue going on, whether applied usefully to work or not. The waste products of such combustion accumulate proportionately, but are not so adequately disposed of as when the circulation is stimulated by the mechanical movement of the muscles in use. The result is a kind of energy blockade and a clogging of the muscles with fatigue products when there has been no activity. Sometimes this energy breaks through in the form of spasmodic movements, or makes itself apparent in other uninvited ways. No wonder the cramped and nervous worker watches the clock, and pines for the hour to rush forth from the factory! No wonder, either, at the consumption of coffee, coca-cola, and other stimulants, to promote a circulation that should be got by exercise.

Releasing the industrial tension. The practical reason why we should not call mere work-staleness "fatigue" lies in the fact that words have suggestion values, as well as meanings. The suggestion value in the word "fatigue" is the idea of rest. If we were dealing with true fatigue in the conditions we have described, the proper remedy would be to "knock off work." This remedy is too drastic if it means reducing hours of work to uneconomic lengths, and if some other devices can first be tried.

An astonishingly complete and very useful recent pamphlet of the National Safety Council — Safe Practices Pamphlet, No. 50 — entitled "Practical Methods for Reducing Fatigue," should be studied by every one interested in factory work. It gives practical remedies for all the conditions of strain commonly identified with fatigue. Like all the literature of the Council, this pamphlet is severely practical and to the point. It takes no account of what might be called quibbles on the difference between true and apparent fatigue. It is written for the average factory man who does n't care what causes fatigue so much as what will offset it. For an encyclopædic survey of the subject, treated from this practical angle, I know of nothing more helpful than the Council's bulletin.

Yet even in this survey of the subject it is apparent that there are many counteractives of so-called fatigue that do nothing to diminish the amount of physical exertion by the worker, and that some of them aim to increase it.

Frank and Lillian Gilbreth have been able greatly to increase output on specialized operations by adapting work chairs and other equipment to the workers in such a way as to reduce wasteful strains and defense reactions. Chairs fitted with springs, with comfortable backs, chairs and benches adjusted in height to suit the worker, and convenient foot rests are among such devices. The Gilbreths call their work "fatigue-elimination," and for popular discussion the phrase will serve, but it is more accurately "strain-minimizing," which is a very different and special thing. Such adjustments are needed, but, in addition to that, we need a good deal of fatigue-producing; that is, a means of using available energy up in a healthy way. "Rest periods," so-called, are in point; provided the workers are not allowed to rest. Henry T. Noyes, of Rochester, gives the rest periods, but stimulates the people to dance or play games instead of sitting down in the same cramped positions as those required by their work, while reading newspapers or knitting. The Joseph & Feiss clothing plant, instead of giving rest periods, so-called, requires the workers frequently to get up from their sewing machines and carry good-sized bundles of work to the next work places, and makes much of noon-hour recreation.

The place first to attack so-called "fatigue" is clearly at the work which produces it. If monotony causes the body to go stale, some means must be found of putting variety of activity into the operation. In place of the too specialized use of small muscles, we must call upon the larger muscles. And we must not forget that pleasant interests in work stimulate circulation through the activity of the suprarenal glands.

But it would be an error to assume that such remedies can altogether take the place of self-directed recreation and activity outside of working hours. So far as practical, we must still look to shorter hours for the best tonic. The constraining effect of mere hours of light work is not easily appreciated. When the factory system first started up in America and the cotton mills began to pull in operatives from the farms, people worked at their looms from twelve to fifteen hours a day — as long as there was daylight to see by. Even children of five or six were employed, and toiled these long hours. We are horrified nowadays to contemplate such things, and consider that the employers of fifty years ago must have been wicked exploiters. And yet, considering their background and knowledge, why should they have done otherwise? Their experience and their workers' experience had been with farm labor, and such long hours at work, even for children, were not alone accepted as right, but they even proved to be healthy. Why should "easy" indoor labor, which, for the most part, consisted of sitting down, merely watching a machine, be regarded as any more arduous? And for a long time, indeed, it was n't arduous. The textile industry was, and largely still is, a family industry, where husband and wife could be employed for the same task, and alternate on the job, the man farming one day and running his loom the next. Such change of occupation from day to day was a sufficient outlet for energies. So long as there was an opportunity to alternate mill work with farming, there was little harm in long hours.

The textile industry was the first in America to develop on a large scale the modern form of factory labor. Its traditions were taken over by those which sprang up later. The others, however, did not provide the saving opportunity to alternate indoor employment with farm and home work. As industry specialized and subdivided, long hours of monotonous light work began to irk and weary the wage-earners, and they had to enter upon a long and uphill fight for reasonable hours.

To this day, indeed, fixing hours of work is largely a matter of "collective bargaining," rather than of scientific determination. Not only is too little known to reach scientific conclusions as to a proper day's work, but even the broader facts have been misrepresented by faulty ideas of fatigue. The worker knows that he tires, and even suffers, from his monotonous job. The employer looks upon the work, sees how light and "restful" it is, and a dispute naturally follows. The issue is confused by a discussion of fatigue, which is not usually involved.

What has happened, by this time, to our initial idea that factory work produces fatigue and fatigue causes accidents? To my way of thinking, our reasoning has brought us up to a wholly new point of view. We have n't discovered anything to disprove that accidents are likely to be more frequent as the day wears on, but we are likely to form a different conclusion about the information. We are likely to decide not to worry much about work that is genuinely fatiguing, because it is usually healthy. We shall rather give our attention to the great bulk of work that is too depressing — too wearisome to the attention, too monotonous. We shall consider that we have a health problem, not a fatigue problem

This is not to say, of course, that workers do not grow weary with the passing of the day. They do tire, and as they yield to the feeling of lassitude they are likely to sustain accidents, through sluggish reaction or sheer inattention. The figures have a trustworthy bearing on that point. As accidents increase through the day, however, men may be working faster and producing more, precisely because they are seldom deeply fatigued. They may turn out more pieces, and yet be less watchful of safety because feeling out of sorts. The common sense of the situation calls the "tired feeling" fatigue, but it does n't mean overwork, as those who quote the statistics so plainly do. The common sense, therefore, seems to be more reliable than the figures "That tired feeling" does produce accidents, but it may be a symptom, not of too much bodily exertion, but of too little.

It is precisely because of the fact that the remedy for what is called fatigue may, in one case, be to slow up the demands upon the worker, and in another to increase the load, that it becomes a matter of first-rate importance in all the vast amount of discussion of fatigue to distinguish between the various causes of the feeling of lassitude. As causes differ, the remedies often may differ. In order to make this still a bit clearer, let us consider what would be a good procedure in analyzing a typical problem of fatigue in a factory, and attempt to recommend remedies.

It is not advisable to confine our attention to a single operative, because the circumstances of any one case would be misleading. Let us rather take a whole department. A good example would be the cleaning department in a foundry. The operatives receive castings from the "knock-out" room (where the sand, chills, nails, etc., are removed from the freshly molded castings) and with pneumatic chisels and with hand tools chip off the excess metal — burrs, fins, risers, and gates. The castings may be of various sizes, some rather heavy, and not all will be handled by cranes. I choose this example, because much of the work is sufficiently burdensome to give rise to expectation that it will cause true fatigue. Let us assume that our attention is drawn to this department by a series of accidents caused by the workers' permitting castings to fall on their toes or crush their fingers. Analysis of production by hours shows some falling off toward the latter end of the day, and the accidents seem to occur more frequently at 11 o'clock in the morning, with another peak toward 3.30 in the afternoon. Closer study, however, shows that some men increase their production during the afternoon, and that some of the accidents happened to some of these men. Our problem is twofold: Is fatigue an important factor in these accidents, and, if so, how can it be reduced?

We must solve this problem by excluding as many factors as prove to be irrelevant, as we go into it. First, we sort out the men who neither decrease in rate of output nor sustain accidents. Obviously there is a group who are so well fitted to the work that there is no fatigue problem. It will be useful, in passing, to rate them, in weight, height, physical condition, age, mentality, experience, personal habits, temperament, etc., to compare them, item by item, with similar groups who do show a decreasing production record, and especially those who have sustained accidents. This comparison may aid us in selecting and assigning workers to this department.

Having determined that only some of the workers evidence even the possibility of fatigue, we next inquire whether the doubtful group have in any cases brought fatigue into the plant with them. Dissipation, sleeplessness — whether from insomnia or merely late hours — drink, excessive exertions outside of working hours, or such depressions as those due to auto-intoxication and other disease, will account for a definite proportion of so-called fatigue cases. Another group will evidence physical unfitness for this class of work, improper build for stooping and lifting, improper nervous organization for handling pneumatic tools, in noisy, dusty rooms, or sheer weakness. Any such men may be said to bring fatigue to their work.

With a diminishing number of possible fatigue cases before us, we next inquire whether mental factors of distraction, boredom, worry, or insanity are affecting the production and accident records. We may succeed in excluding a few more cases on these accounts.

Let us say that a certain proportion are left who are strong men, in good mental health, fairly intelligent, and sufficiently experienced, who do fall off in production during the day and who do sustain injuries. These will be our genuine fatigue problems, if any. The remedies will be next in order.

First, we should see whether the men are not trying to overdo, outstripping their neighbors to increase their earnings. We may have to discourage some "speed merchants." Study of hourly production may also reveal some whose work is spasmodic, giving evidence of overstrain at certain periods, and not showing up in the total day's production. A better distribution of effort may be brought about, sometimes, by checking up excitable foremen who drive their men too much at certain hours, or excitable workmen of uneven effort. In other cases we may find anxious workers who, to save time, lift, by hand, castings that should be handled by crane; or men who stoop over and clean castings on the floor which should be lifted to bench or other support; or we find an inadequate provision of equipment for supporting castings at convenient heights.

Assuming that we are able to mitigate inconvenient working conditions, and to improve faulty work habits, and that we still have some evidences of fatigue in some cases, our next step will be to ward off or counteract these effects by means of applying the laws of the physiology of fatigue.

In the instance of the foundry labor conditions are ideal for supplying a sufficient amount of exertion. There is, at least, no energy blockade such as there may be in more sedentary labors. But we may need to supply better nourishment, a more scientific distribution of rest periods or changes of load, or just plain mental stimulus in the way of happy relationships, or more exciting social conditions or differential pay — which we have analyzed more fully in several other places.

It will be observed that all of the above procedures are independent of, and antecedent to, the too obvious remedy for supposed fatigue; *less work*. If all other measures fail, we have to assume that we have a condition of true fatigue which can only be remedied, and, therefore, must be remedied, by a reduction in hours and a lowering of production standards.

Such an analysis, even of an occupation involving heavy labor, indicates how large a proportion of the fatigue problem is really not a problem of overwork, but a disguise for boredom, or ill-health. Any of the other mental conditions we have discussed will produce effects that seem to point to overwork, and that may, loosely, be called fatigue. This term, however, should not be made too easily to serve for every condition of mental and physical ill-health connected with factory work, because it is likely to lead us off into faulty remedies. With proper adjustment of men and working conditions to each other, it is possible to achieve the result which every factory should set before it as an aim:

More Work with Less Fatigue.

CHAPTER X

ACCIDENT HYGIENE

Diminishing returns in safety work. Accident *prevention* is already with us. It is a two-phase routine; first, of putting locks, bars, screens, and fences on dangerous machinery, with a view to making it "fool-proof"; second, of pasting up danger signs, scarifying pictures, and catchy slogans, to persuade workmen to use these safety devices. There is little in the system, however, to make men less foolish, or to segregate self-endangering men in places where they are not likely to hurt themselves. Accident prevention takes men as they are and treats every one alike.

Accident *hygiene* is a development of safety work from this point on. It presupposes the existence in a factory of all the well-known mechanical safeguards. It takes for granted that the State factory inspectors have caused gears to be screened, belts to be guarded, and devices to be set up which will shield the fingers of operatives from getting crushed or cut in machines, at the point of operation. It counts upon the assistance of the compensation insurance companies in keeping safety committees alive, to consider safe clothing, safe lighting, and safe methods of operation. It assumes that we have largely won the battle to get factories to establish medical departments, or, at least, first-aid departments, competent to deal with injuries promptly, in order to reduce infections and other complications.

Indeed, unless these things *have* been accomplished, there is no place in the given factory for accident hygiene. Prevention, such as above described, is necessary; first, because all men *are* alike in many things; indeed, they resemble each other more than they differ from each other. It is economical to deal with them, at the start, with respect to those traits and tendencies which they have in common. If we were to begin the other way around, and treat every factory hand first as an individual, setting up such safeguards as were necessary for him, and establishing a tickler system telling us how often to remind him to be careful, and writing up slogans and warnings in terms which a study of his personal psychology required, we should quickly make a discovery. We should find that what began by being a burdensome toil was lightening, as we passed from man to man. John would prove to be so largely in the same situation as Andrew, next to him, that nine tenths of the material we provided for the one would be suitable for the other, without change. We should find that some things were true of *every* workman. If they were alike fifty per cent and different fifty per cent, therefore, we could get half of our results with a single effort, aimed at the whole lot of them; whereas the other half of the results would cost many times as much labor — a special effort for each man. We should naturally, of course, do, first, the things which yielded the biggest results.

In the safety movement, however, industry has already reached the point of diminishing returns from further efforts with broadside remedies and shotgun prescriptions. In a single decade it has reduced the severity and frequency of accidents in a marvelous fashion. It has written into law and into standard practice a routine of mechanical safeguards and safety instruction and inspection which reaches practically every factory in the country. And the chief concern of safety engineers, now, is not to conquer new fields and new situations, but to hold the gains made, to sustain the enthusiasm and interest already aroused, and to keep safety committees going. The fight, the anxiety and excitement of pioneering, have gone out of the job; the safety movement has entered the phase of gleaning. Refinements of old equipment; revisions of, and more "active" photography in, old bulletins; new stunts to keep committees awake; new accident tables to keep managements interested — these are the subjects which occupy the engineer.

It is not surprising that the work sometimes becomes stereotyped and ineffective. Ideas that once proved stimulating are now worn threadbare with repeated use. When railroads began to stencil the words "Safety First" on all box-cars, the public ceased to read them. We don't heed the slogan, "Always Be Careful," or "Don't Get Hurt," stamped on a carload of steers, any more than the cattle do. We may note the comments which Weary Willie has chalked up on the outside, telling the "bo's" to avoid Buffalo. We may even give attention to the oddity of the phrase, "The Road of the Big Baked Potato." But "Safety First" are words which we have read before; they are part of our usual environment. If part of our usual conduct is to be careless, the slogan goes along with it. It is astonishing, indeed, how many moral precepts we can carry with us comfortably into the very act of wrong-doing. A hardened sinner can ply his sinful trade, while prating sentiments of contrary import, as blithely as a juggler can toss up five billiard balls while balancing a lighted lamp on his head. And so, the careless workman has long since learned to take all of the usual hurdles, without paying much attention to the photographs of mangled fingers on the bulletin boards. He *expects* the bulletins; he knows just where *not* to look for them.

For a while the tendency of commonplace safety devices to lose their effectiveness with re-use can be overcome by making them more common. And so, the bulletins are set up more frequently; the slogan is inserted even into the pay envelope. In the course of time, however, the limit of absurdity is reached in this, and further repetitions have no more weight than do the prayers which Mohammedans in India print on long strips of paper and wind up on a wheel, in lieu of reciting them.

It would be a mistake to belittle the safety work already accomplished. Nothing which we can henceforward do will be capable of yielding as large further returns in accident prevention as have already been secured. Up to ten years ago, our industries each year were killing 35,000 men and injuring 2,000,000 more. The safety movement has worked astonishing improvement in this record. Some plants have secured 80 to 90 per cent reductions in their accident figures in a period of five years. A bulletin of the New York Department of Labor [1] reports reductions of accidents in the National Tube Company's McKeesport plant of 85 per cent, in the American Smelting and Refining Company's Omaha plant of 90 per cent, and in the Eastman Kodak plant of 80 per cent. The Na-

[1] Bulletin No. 77.

tional Harvester Company in five years cut its deaths and its other accidents each down 60 per cent. Measuring the ground between the point at which safety work began and the theoretical condition of "no-accidents," over 50 per cent of the distance has already been traversed. The idea of accident hygiene, therefore, can only be builded on the premise of accident prevention.

It rarely happens, however, that old conquests can be held secure by old methods. In safety work, we need a change of methods — or, at least, a larger repertoire of methods — to maintain the gains already made. And, for the purpose of still further reducing accidents, it is obvious that we must devise new schemes and discover new approaches. It seems evident that the broadside propaganda has lost most of its power to produce new results.

Accident hygiene. Accident *hygiene* — the next step — is a technique for dealing with individual cases, in special ways suited to each. Accident prevention, on the one hand, is like public-health work. Accident hygiene, on the other, is like prescribing for sick people individually, as their cases require. Public-health work requires dairies to be inspected, water supply to be rendered pure, sewage to be disposed of, infectious diseases to be isolated, and flies and mosquitoes to be fought. It does everything possible to preserve the health of the whole community. Private medicine, nevertheless, finds much illness to treat that cannot be prevented in this wholesale way. And so, too, we find that, after we do all of the accepted things in safety work, we still have many accidents arising out of the special circumstances affecting individuals, and we must also supplement general safety devices by prescribing a special kind of safety medicine. After we treat men for accidents growing out of traits in which they are alike, we must treat them for accidents growing out of traits in which they differ.

This book has not, of course, dealt with all the various ways in which men are likely to differ from one another, but it has classified some fifteen types of individual variations which are sources of mental accident hazards. The majority of special cases will, I believe, fall within these classifications.

ACCIDENT HYGIENE

The preceding chapters have not laid special stress upon remedial measures, but upon analysis. The prime need, first, is proper diagnosis. We must be sure that we know the psychology of men who get hurt before we can fit measures to that psychology. And the proper knowledge of causes usually carries, implicitly, a suggestion of the cure. There was another reason, besides, for not laying too much stress upon remedies while dealing with each cause. As we go back over the subjects discussed, we find, generally, that no one remedy can deal with the trouble — it usually takes two or three in coöperation; and, again, the same procedure called upon for dealing with one bad condition has to be brought in to alleviate another.

Thus, in considering the question of *faulty attitudes* of workmen, we see that we must approach stubborn individuals through individual contacts — of service workers, foremen, etc., through organized enthusiasm, in committee government and activities; and through the very atmosphere of the shop, which is created by the whole programme of the management. On the other hand, we use these individual contacts, this group spirit, and this atmosphere of the shop, to accomplish improvements also in cases of *faulty habits*, of *inattention*, of *worry*, and of other causes of accident.

To show the interaction of the various types of remedies upon each cause and upon each other, the writer has worked out the accompanying chart. It is a compact summary of all the procedures implied in the discussions of preceding chapters, and, beyond that, it locates what seems to me to be the proper relationship of other common aspects of employees' service work.

Discussing them briefly, it will be noted that I have considered eight types of remedies: (1) job analysis, (2) improved working conditions, (3) better selection and assignment, (4) training, (5) organization, (6) periodic personnel surveys, (7) individual adjustments, and (8) accident "post-mortems."

Fitting the man to the job. Job analyses are written descriptions of jobs, intended primarily to furnish the basis for hiring men who will be capable of performing the work to which they

MENTAL CAUSES OF ACCIDENTS	TYPES OF REMEDIES AN			
	JOB ANALYSIS	IMPROVED WORKING CONDITIONS	BETTER SELECTION AND ASSIGNMEN	
			MENTAL FITNESS	PHYSICAL FITNES
IGNORANCE OF ENGLISH	TO DETERMINE LANGUAGE HAZARD		ASSIGNMENT BASED ON LANGUAGE HAZARD LITERACY TESTS	
INEXPERIENCE	LEARNING PERIOD BY AGE GROUPS PROBABLE CHANCE OF ACCIDENT AT EACH LENGTH OF EMPLOYMENT	CHEERFUL ATMOSPHERE FOR LEARNERS	TRADE TESTS SOCIAL HISTORIES PREFERENCE IN DANGEROUS JOBS FOR EXPERIENCE	
MENTAL LIMITATION	TO DETERMINE MINIMUM MENTAL AGE SAFE FOR OPERATION		ASSIGNMENT BASED ON INTELLIGENCE TESTS	
PREDISPOSITIONS SENSE DEFECTS	TO DETERMINE SENSE REQUIREMENTS			ASSIGNMENT BASED O TESTS OF SPECIAL SENSES
MENTAL SETS FAULTY ATTITUDES EXCITABILITY		ATMOSPHERE OF GOOD WILL AND CONFIDENCE IN THE MANAGEMENT	STUDY OF SOCIAL HISTORY TO REJECT MISFITS	TEST FOR EXCITABILITY
SUBCONSCIOUS ERRORS	STUDY OF POSSIBLE SOURCE OF MENTAL ERROR	STANDARDIZED SAFETY DEVICES · CONDITIONS · MACHINES · SPACINGS ETC.		
FAULTY HABITS (HURRY)	MAKE CHECK LIST OF SAFETY HABITS	STANDARD TASKS STANDARD ROUTINE ALERT SUPERVISION	WORKING TESTS	
INATTENTION BOREDOM	STUDY OF TEMPERAMENT SUITED	LEADERSHIP PAYMENT BY RESULTS GOOD TOOLS ETC. HOURS	ASSIGNMENT OF TEMPERAMENT SUITED	
DISTRACTION	ANALYSIS OF SURROUNDING CONDITIONS	BETTER SCHEDULING SELF-CONTROLLED MANAGEMENT	TESTS FOR CONCENTRATION AND RESPONSE	TESTS FOR RESPONSI TO PHYSICAL STIMUL
PREOCCUPATION WORRY, STRIFE		CONTINUOUS EMPLOYMENT FRIENDLY MANAGEMENT	STUDY OF HOME SITUATION PREFERENCE FOR SANGUINE TEMPERS	WEIGHT, NUTRITION AND SLEEP
MENTAL DISEASE			SOCIAL HISTORY ESPECIALLY JOB STABILITY	OBSERVATION OF SIG WASSERMANS, SPINA PUNCTURES, ETC. FOR PHYSICAL SIGNS
DEPRESSION DISEASE	PHYSICAL HEALTH AND STRENGTH REQUIREMENTS	MINIMIZED INDUSTRIAL DISEASE HAZARD		CASE HISTORY EXAMINATIONS FO HEALTH AND STRENG CLASSIFICATION
DRUGS, DRINK, ETC				OBSERVATION FOR PHYSICAL SIGNS AND SYMPTOMS
FAULTY PLANT CONDITIONS	CLASSIFICATION OF JOBS IN TERMS OF OCCUPATIONAL DISEASE HAZARDS	ADEQUATE LIGHTING VENTILATION		ASSIGNMENT B... ON CLASSIFICA...
ENERGY BLOCKADE SO-CALLED *FATIGUE*	STUDY OF MENTAL AND PHYSICAL TYPES SUITED	RECREATION REST-PERIODS STRAIN-MINIMIZING-EQUIPMENT CHANGE OF WORK		ASSIGNMENT B... ON TYPE OF EN... INDICATED

OW THEY AFFECT EACH CAUSE

AINING TRINATION)	ORGANIZATION (MOBILIZATION)	PERIODIC PERSONNEL SURVEY	INDIVIDUAL ADJUSTMENTS	ACCIDENT POST-MORTEMS
H CLASSES REIGNERS GHOOLS FOR RATES				INTERVIEWS
FIRST CLASSES GINNERS		PERSONAL FOLLOW UP OF ALL BEGINNERS WITH REFERENCE TO LEARNING PERIOD ETC.	TRANSFERS WHEN NEEDED TO CORRECT FAULTY SELECTION	FORMER WORK EMPLOYMENT DEPT. RECORDS-INCLUDING DATE OF EMPLOYMENT
OF MENTAL AND INSTRUCTION H CLASS		QUESTIONING ALL REPEATERS AND ALL WHO SHOW INABILITY TO LEARN		RECORD OF MENTAL TESTS FOREMEN'S RATINGS ETC.
TINS IED FOR EFFECTS		ESPECIAL STUDY OF FOREMEN'S FIRST RATINGS	TRANSFERS WHEN NEEDED TO CORRECT OVER-SIGHTS ON PHYSICAL EXAMINATIONS	RECORD OF PHYSICAL EXAMS FOREMENS RATINGS ETC.
L EDUCATION ACH TYPE OF ATTITUDE	SHOP COUNCILS TO ENLIST THE "CONSENT" OF WORKERS	FOREMEN'S RATINGS	INTERVIEWS BY SAFETY SERVICE, AND MEDICAL DEPARTMENTS SEGREGATION OR DISCHARGE OF "KICKERS"	TESTIMONY OF FELLOW WORKERS FOREMEN'S RATINGS
IGS ON SOURCES CONSCIOUS S AS SED				STUDY OF THE ACCIDENT
NT DRILL BASED ON STUDY ULE SCHOOL GINNERS	MANAGEMENT PULL-TOGETHER TO SECURE STANDARDIZED METHODS	REPORTS OF BREACHES OF SAFETY HABITS	REEDUCATION FOR INCORRECT HABITS DISCIPLINE	STUDY OF THE ACCIDENT STORY OF INSTRUCTORS
ITY TO EST MEN S	RECREATION CLUBS SAFETY COMMITTEES SHOP COUNCILS ETC TO ENLIST INTEREST SUGGESTION SYSTEMS ETC	FAILURE TO MAKE EXPECTED DAILY PRODUCTION WASTE RECORD	TEMPORARY OR PERMANENT CHANGE OF WORK	PRODUCTION, QUALITY AND ATTENDANCE RECORDS
	FUNCTIONAL CONTROL OF PLANNING ETC TO SECURE SMOOTH OPERATION	SURVEYS OF WORKING CONDITIONS		STUDY OF THE ACCIDENT TESTIMONY OF THE VICTIM
ADING RS TO BRING LS TO CE DEPT	SHOP COMMITTEES TO HELP BRING OUT CAUSES OF COMPLAINT AND TROUBLES	ABSENTEEISM OUTPUT RECORD EXCESSIVE WASTE RERATING OF FOREMEN	HOME VISITS BY SERVICE WORKERS MENTAL HYGIENE	HOME INQUIRY STORY OF VICTIM STORY OF FOREMEN
		QUARRELS AND INSUBORDINATION AS REPORTED BY FOREMEN	PSYCHIATRIC CLINIC FOR ECCENTRICS TREATMENT OR SEGREGATION	PSYCHIATRIC EXAMINATION STORY OF ASSOCIATES
		CHECK UP ON EXCESSIVE ABSENTEEISM ON BASIS OF EXPECTED RATES	TREATMENT BY MEDICAL DEPT. DENTISTS ETC	PHYSICAL EXAM. SICKNESS RECORDS
			STRICT INDIVIDUAL FOLLOW-UP WITH DISCHARGE IF NECESSARY	PHYSICAL EXAM. FOREMENS STORY
		PHOTOMETER READINGS FOR ILLUMINATION HUMIDITY READINGS ETC	TRANSFERS WHEN RECOMMENDED BY PHYSICIAN	STUDY BY SERVICE DEPT. AND BY SAFETY COMMITTEE
		OUTPUT RECORD STUDY OF FAILURE TO MAKE STANDARDS REEXAMINATIONS IF NECESSARY	ADJUSTMENT OF CHAIRS BENCHES ETC. VACATIONS TRANSFER IF NECESSARY	PERSONNEL SURVEY PRODUCTION RECORD BY HOURS EXPERT "JURY"

are assigned. The need for such a catalogue arose when employment was centralized and employment managers were asked to select workers for a wider range of jobs than any one man could be familiar with. They were devised as cyclopædic indexes of the skill, experience, and physical equipment required in each operation. In course of time, however, it was discovered that the concentrated attention summoned for studying jobs, so as to describe them, also involved, oftentimes, the discovery of methods for improving them. Furthermore, it became evident that for the successful conduct of a job much more was required than skill, experience, and strength. There were, likewise, intelligence, attitude, temperament, and other qualities which were seen to influence a workman to remain happily on the job, produce abundantly, exert a good influence upon his fellow workers, and avoid the accident hazards that go with the operation. Thus we see that, after all questions of capacity to do the work are dealt with, we must go over the whole ground again, in connection with safety. We have to consider whether a non-English-speaking worker will be a special hazard; reckon for how long a time a learner needs watching; investigate whether the surroundings are more dangerous and call for more intelligence for safety than the actual job requires for efficiency; inquire whether sense defects of one kind or another would prove particularly dangerous; and observe what physical and mental qualities are required in that job, to keep a workman interested, and reasonably free from energy blockade, or "fatigue," and healthy in the given physical conditions.

Such studies are the necessary first step in dealing with mental causes of accidents, because, obviously, the next two remedies — improved working conditions and better assignment — grow out of them. In the first place, so far as physical and other working conditions influence the mental states of workers, we must find our key to improving these conditions by studying each individual operation in turn. *Subconscious errors*, as we pointed out while considering them, usually spring from the failure to find surrounding or accompanying circumstances the same in two situations, when essential conditions are the same. A man transferred from one lathe to another, to do the same work, expects to find all spacings of working parts and all positions of control mechanisms the same on the two machines, so that his habits will not be disturbed. To effect the needed standardizations for safe operation, therefore, requires a preliminary job analysis. Again, in order to minimize occupational disease hazards, to ensure adequate lighting and ventilation, and to devise strain-minimizing, or habit-serving, equipment — all this requires job analysis, a continuing and a perpetually improving study of the fitness of the man and the job to each other.

There are, of course, additional circumstances in connection with working conditions which do not thus vary with individual jobs, and which do not show up in these analyses, but which do strongly affect the psychological conditions. They are chiefly circumstances of the character of the management. It is management, which helps remove *faulty* *attitudes* when it creates an atmosphere of good-will and belief; management, which helps cure *faulty habits* when it provides standard training methods; management, which minimizes *inattention* caused by ennui when it pays according to results and furnishes good tools and inspiring leadership; management, which offsets *distractions* and prevents noise and confusion when it furnishes long-headed planning and calm, dignified supervision; and it is management, which reduces *worry* and *strain* when it causes contacts within the plant to be as friendly as possible. The working conditions, in short, affect the worker from two angles; from the point of view of the special attributes of his job, and from the point of view of his general treatment at the hands of management.

Workers are selected, however, subject only to the special demands of the job. The character of the management is a help or a handicap, as may be. The employment manager, in choosing an operative, must consider only the equipment of the worker and the demands of the job as functions of one another. The job analysis, therefore, furnishes all the help which the employment manager can assure himself in carrying out his purpose to hire, for each opening, only a man who will be safe. He needs all the assistance he can get from any source, because of the great importance and promise of proper hiring. The obvious economy of this effort lies in the fact that, if it were a perfect success, nothing else would be necessary; men would not get hurt. Theoretically, perfect selection and assignment would stop, at the source, the type of accidents we are here considering.

Now, for the last five years, industry has been talking big things about scientific selection of workmen. Here and there interesting experiments have been tried. The Dennison Company did some good job analyses a year or so ago. The Joseph & Feiss Company has made some psychological tests for general intelligence. Dr. Henry C. Link was, for a brief while, permitted to hire for several departments in a New Haven factory, on the basis of sense tests. There may be other partial instances. But I know of no factory or business house in the United States which really and consistently has scientific selection of workmen. When times were flush, managers did n't dare make thorough tests, because they might antagonize workmen, and there was no opportunity to choose, anyway; you must hire all you could persuade to work for you. Later, when the labor market eased up, times were bad, and scientific selection was considered too costly. Spending money freely could n't even *buy* scientific selection to-day; the technique has not been developed. We may say, however, relative to reaching out for men who are likely to be safe, that, when job analysis has established real specifications — mental and physical — for each operation, we ought to be able to eliminate those who are predisposed to accident. It ought to be possible, by intelligence tests, sense, and other physical examinations, and some kind of tests for temperament (yet to be developed), to gauge men "Go" and "No-Go."

In the meantime, we can at least make use of "social histories"; that is, the significant facts about applicants' previous adjustments. There is already enough known, about the co-ordination between success in school for each age and intelligence; between length of service and earnings in previous jobs, and present fitness for industry; between marital experience, migrations, and one or two other symptoms of emotional situation, and a man's prospective mental health; so that, if these facts were ascertained before putting an applicant to work, the employment man could generally predict the worker's further progress. It is not usual to make inquiry with regard to these factors, or to look at them as interrelated and symptomatic. There they are, however, available for use. And they *must* be used, if mental tests are ever to be generally and economically employed in hiring, because social histories can be made sufficiently reliable to classify the great bulk of applicants as normal, without further inquiry; thus reserving finer tests for border-line or puzzling cases, and for critical situations.

There is, of course, an ever-widening range of criteria and tests which may be used in selecting men. I have indicated on the chart more than are likely to be utilized for some time to come, but I do feel that the physical examination in industry has been a failure when viewed as a possible aid to assignment. If plant physicians would absorb the data on job analyses, and spend only a little more time with each applicant, they could offer great assistance to employment managers by determining sense endowments, response to stimulus, endurance, and other prime factors of intelligence and fitness of applicants.

Individual education in safety. In the meantime, selection being still so haphazard and so unscientific, we are forced to rely, for control of mental accident hazards, mainly upon individual improvement and adjustment after hiring. We must, first, design a system of training which will put the knowledge of safe practices at the disposal of all workers, in terms that will reach their minds individually; drilling each according to his deficiencies. We must then so organize the workers themselves that they will desire to put this knowledge into use.

Education and organization are, of course, not new in safety work; the one exists familiarly through the medium of the bulletin board and the safety meeting; the other is common in the form of an elected safety committee, with power to consider accidents and recommend safeguards. At present, however, education is not made personal; that is, it is not adapted to varied types and states of mind; and organization is not permitted to go far enough; that is, it is not consciously extended in its scope to cover the antecedent mental causes of accidents.

More highly individualized education will, first, classify workers as mental risks. Beginners will be tagged as the gravest problem; those known to be of feeble wit, or of undisciplined, awkward habit, or of contrary, uncoöperative temper, will all have separate guide cards or index tabs in the safety engineer's card catalogue, and he will devise special approaches for each group. But with fuller knowledge of psychology, the informed management will not, as at present, rely for safety instruction solely upon appeal to the conscious, voluntary awareness and coöperation of the workers. They will realize that a solid habit, even stupidly adhered to, is worth a dozen spasms of good resolution which grow out of fear of getting hurt. They will, therefore, devise routines of work habits in which safety is implicit. We have instances of them in the goggle habit, the finger-stall habit, and the like; but only in rare cases, under scientific management, have we applied motion study. The field of habit formation in industry is but scratched. I see good reason to believe that we shall find the vestibule school not only the best place to concentrate on habit-training, but also the best laboratory.

One other type of instruction rarely resorted to will prove to be of help in connection with difficulties arising out of *ennui* or *energy blockade* or *worry* — even out of *mental disease.* There needs to be developed a course of study in how to look for contentment. Workers should be constantly reminded of their right and opportunity to be happy, constantly exhorted to call upon the employees' service department for assistance in straightening out their troubles. There is no situation in any one's life so painful but it may be relieved in some manner. It is possible to adjust conditions for comparative happiness even when it is necessary for long periods to accept a handicap or a privation. Pernicious ideals of Puritan religious beliefs have, nevertheless, either narrowed the range of inquiry into sources of happiness or ingrained the belief that sorrow and want are the expected and necessary elements in our lives. These ideals, of course, have not prevented the mass of people from seeking happiness — that quest in most people is irrepressible. But they have caused the effort to be made clandestinely, as a search for forbidden fruit, like stealing one's own strawberries by moonlight. Crime and mischief are not the only devious and unhappy results of such an attitude. Industry and all the other social institutions feel the effects, in terms of destructive criticism by unhappy individuals who do not frankly recognize the more personal, the internal, sources of their own discontent.

Where the cult of unhappiness succeeds in winning acceptance, the result is even more unfortunate. It produces a dead soul, without further power to react to good suggestion, without ambition to produce efficiently, without hope to coöperate in a programme of public or even of family improvement. When a man is once convinced that he has a bitter lot, that nothing can greatly improve it, that no person greatly cares what becomes of him, and that even such religious advisers as he has been taught to accept consider his case quite bearable in *their* philosophy — and when he does n't any longer even try to *fight* — of what further use is he?

Emotional troubles and mental diseases in industry, as elsewhere, do not necessarily result directly from family troubles, secret sin, or deprivation. They arise from inability or refusal to recognize the cause and extent of the difficulty and failure to find disinterested aid in attacking it. Most people have burdens to carry around with them, but those who know how to deal with them frankly know how to be happy in spite of them. For no situation need be permanent; we can always adopt at least a long-time programme of relief.

It is quite possible in industry for management to educate workers to the expectation of happiness and to coöperate with them in achieving it. The important thing is to persuade them to call in, for advice, so that the service manager can help them. It may be necessary to point out quite other outlets for energy and ambition than they at first look for. They may have to be persuaded to scale down their hopes, or lengthen their programme, or pay more in terms of forbearance or of effort than they like, to obtain their happiness. It is quite possible, nevertheless, to get many discontented or inert folk started on a constructive and realizable quest for contentment. That factory is on the road to general mental health where the workers have been taught to believe that they have a duty to cry out when they suffer, and to "kick" when conditions get too bad; where operatives are convinced that their bosses will help them change things which are wrong. Education for safety, therefore, which has for its aim the creation of safe emotional conditions, will not talk so much about mangled fingers as at present. It will aim more at cultivating a healthy refusal to be downhearted.

The organized effort which grows out of this view of education, naturally, will not confine itself to the consideration of actual accidents alone, nor of mechanical safeguards, and other immediate problems. It will, rather, aim at providing those outlets for suppressed emotions which partially satisfy starved desires; it will try to furnish a constitutional means for workers to consider and adjust their own difficulties and complaints. Social and recreational organizations and shop committees have a place in the safety movement, even if accidents are never brought up in them for discussion.

Personal audit and adjustment. After these more indirect efforts for education and organization are well launched, however, there will be many persons who will blunder into accidents for reasons intimately related to their mental health. The pursuit of safety, therefore, carries us next into the inner lives of individual workers, which we enter as far as may be and as necessity requires. Not all employees, of course, are subjected to prying inquiry. Only those whose work and conduct indicate some difficulty which they have, themselves, been unable to cope with, are considered from this point of view. It would be not only unfair to the person of normal status to rake into his personal affairs, but also vastly wasteful of the investigator's time to examine every one.

Instead, a kind of perpetual inventory of employees can be instituted, a periodical survey of significant facts which serve as finger-posts to point the way to closer investigations when necessary. The idea underlying this survey is the assumption that normal minds produce normal results, and that, for all practical purposes, when a worker keeps up on his job, we may assume that he is in good mental health. Only when he begins to fall down, especially when he drops below his own normal, should we look into his situation more closely. When piece-work payment has been introduced, there is usually a record of daily production which may be consulted. It is easy to plot curves for a period showing the rise and fall of daily output against a curve for the normal, and a line can be indicated which calls for investigation whenever the production curve touches or falls below it. Then, too, a normal rate of sickness — lower for men than for women — can be indicated and a physical examination may be ordered if absence on account of illness exceeds expectation. There will be also an expectancy index for accidents on each operation. It may exceed 200 per cent a year for electricians and fall far below 100 per cent for other operations. Therefore, when a given individual exceeds the index figure for his operation the employees' service department is justified in examining more closely into his intelligence, his training, his emotional situation. The quality record, the record of waste, the machine stoppages, the discipline record relative to quarrels, insubordination, and attendance — these are some of the other finger-posts which will serve to guide further inquiries into mental health. If the normals have been wisely determined, and each employee is daily measured against the standard and against his own previous record, deviations will be highly significant. Any emotional disturbance, or lack of interest even, will show up in one or more of these records long before conditions get bad enough to lead to accidents. The perpetual personnel inventory, therefore, can be used to forestall accidents if the follow-up and individual adjustment are promptly and wisely undertaken.

With such indications of trouble to guide us, we need have no qualms about making intimate investigations of the cause. Even in cases of maladjustment, however, it is better to make no inquiry at all unless it is done in a friendly and sympathetic fashion, with a mind to offer help. The sole purpose of a mental hygiene study, therefore, is to discover the causes of an obscure trouble which the victim cannot deal with himself, and to help remove it. It is not always necessary to go into "personal affairs" at all. The trouble, though baffling to the subject, may be quite superficial, a thing so simple as may be solved by increasing the wattage of a light bulb, placing a rubber mat under a workman's feet on a cement work floor, or raising the height of a chair. The true mental hygienist never goes further than is necessary to effect a cure. Nature never expends any more energy than is necessary to accomplish a given purpose, and a true scientist, who is a servant of nature, always contents himself with the simplest explanation which will account for a phenomenon, and the simplest means which will bring it under control. The individual adjustment, therefore, as a remedy for mental accident hazards, is a procedure for seeking out the sufficient cause and the sufficient cure.

A fall in production may be due to poor material, tools, or machine maintenance; it may be due to failure to furnish materials promptly or some other failure of management. If so, inquiry into the cause will be abundantly justified even if it reveals no unhealthy situation in the worker's attitude. Where it is his failure, the inquiry may result in a needed shift of work, or the adjustment of some troublesome personal situation which has caused worry, preoccupation, sleeplessness, or ill-health — any of which is dangerous. Sometimes it may be due to strain, or so-called "fatigue," produced unnecessarily by uncomfortable chairs, poor lighting, or too steady application, and it will be possible to rectify any of these conditions.

Absenteeism, excessive waste, quarrels, and insubordination may all be indicative of emotional situations which may have very remote causes. Investigation of these usually leads outside of the factory, and the adjustment may be quite beyond the power of the service man.

Usually it will be possible to be helpful, however, if the employee can be persuaded to open up and discuss motives and ways out and can be led to deal rationally with his worry. Sometimes the trouble will have progressed to the point of actual mental disease. When this is so, the subject will be generally ignorant, himself, of the source of the disturbance. Diagnosis and treatment of such cases is the job of a specialist, and the employees' service worker in a factory who finds himself baffled by the attitude and other manifestations of the victim of mental disease should call in the assistance of a trained psychiatrist, or send the employee to a psychopathic hospital.

The accident post-mortem. The final remedy for mental accident hazards is the constant improvement of technique which may be gained by investigating the reasons for our failures. Every accident which does happen is due to the ineffectiveness of our methods or our work undertaken to prevent it. We should give it at least an educational value, by an accident "post-mortem." With our safety committee assembled, we go over each case, reviewing the circumstances of the accident, and inquiring one by one into the various mental factors which might have caused it. In the chart I have tried to list under "post-mortems" the main sources of information with regard to the different possible mental causes of the accidents. The questions which ought to be asked are given below. A study of this list will indicate some of the factors which ought to be considered also, in making personal adjustments.

QUESTIONNAIRE FOR MENTAL "POST-MORTEM" ON ACCIDENT CASES

In appraising the mental condition of each victim of an accident, consider assignment, training, adjustment, physical condition, and emotional situation.

I. Assignment

1. Is he a "repeater?" i.e., prone to accident?
2. Does the subject understand plain instructions readily? Does he speak English?
3. Has he intelligence enough for the job?
4. Is he physically adapted to the job?
5. Has he adequate sense endowment for the job; i.e., is he too slow, too lacking in precision of movement, is he hard of hearing, or has he poor vision?

II. Training

6. How long has he been on the job? What is his chance of accident for this length of employment?
7. What regular habits are necessary for the safe conduct of this particular job?
8. What habit training has the victim so far had for his job? What improvement should be undertaken?
9. What mental approach is best in undertaking instruction of this particular worker?

III. Adjustment

A. Job Situation

10. Is the man earning a wage sufficient to keep him in comfort and fair contentment? Consider whether the job permits this.
11. Has he lately fallen behind his usual earnings, for any reason?
12. Has he been turning out a satisfactory quality of work?
13. Has he had any trouble with foreman or fellow workers?

B. Attitude

14. Has he any mental attitude of resistance to the guidance of the management? Does he cooperate in carrying out instructions? Is he open-minded to new ideas? Is he unduly superstitious?
15. Has he any constitutional bravado and recklessness?
16. Has he any "pose" inconsistent with safe practices?
17. Is he enthusiastic about his job? If not, how could he be made so?
18. Has he a basis for hope of personal distinction and advancement in his work? If not, what could implant such a hope?

C. Personal Situation

19. Has he illness or any other crisis at home?
20. So far as properly may be determined, has he a normal sex-life? [1]
21. Is he suffering from any undue burden of debt or other financial worry?
22. Is there any occasion for him to fear or brood over legal or other personal complications such as quarrels or thwarted ambitions or desires?

IV. Physical Condition

23. Was the man ill at the time of the accident? Or recently?
24. Has he suffered from any organic impairment affecting his efficiency?
25. Was the man overworked or overstrained at the time of the accident?
26. Were conditions of ventilation, illumination, heating, etc., such as to cause depression?
27. Is there undue noise and disorder in connection with his work?
28. Was there any confusion of orders, change of work or discord to distract his attention?

V. Immediate Emotional Situation

29. Was the victim unduly excited or noticeably depressed at the time of the accident?
30. Had anything happened to anger, frighten, discourage, or distress him?
31. Is he considered, by his associates, mentally sound?

[1] Owing to the comparative simplicity and lack of reserve, privacy, and concealment among factory workers, confession or reputation and rumor often pretty accurately reveal whether a man is "peculiar," or unhappy in his relations with women, or contemplating divorce, desertion, and the like.

CHAPTER XI

THE SELF-GUIDED APPROACH TO PSYCHOLOGY

Confusing the uninitiated. "What is a good book to read on psychology?"

This question has been asked of the writer frequently, during the last year or two, by executives in industry. They have seen many books and articles on the psychology of management, the psychology of selling, and the psychology of this, that, and the other thing, and they have been led to wonder if there were n't, somewhere, a psychology of *psychology;* that is, a real science of the mind which they could apply for themselves. Doubtless, safety engineers who wish to go further into the psychology of safety than this provisional essay has carried them will also echo the call for an up-to-date textbook.

At first blush, the demand for a single book to "read" on the subject seems to belittle the importance of so fundamental a science. A student in touch with the wide range of the literature of psychology, especially one accustomed to the selective process of reading for significant contributions — winnowing the new and vital by each author out of the mass of repetitions of old theories, rewritings of other authors and uninspired padding which make up most texts — would hesitate to rely upon any one writer on mental phenomena. In response to the query for a good treatise on psychology, therefore, I glance at the precious titles in front of me, and the temptation is to reply: "You must read thirty-five!"

There is an element of reason, however, in the request. A novice has to begin with some choice, and he naturally wishes his first book on psychology to do three things: to talk to him in language which he can understand and which will interest him; to give him a complete picture of the scope of the subject; and to give him some useful knowledge which stands, so to speak, on its own legs, without reference to other reading, so that, if he never finds time for another book on psychology, at least he has gained something.

However reasonable this desire may be, it is extremely hard to satisfy it. In the first place, the experts are not yet agreed on what constitutes psychology; each is likely, on the one hand, to treat a part of the field as if it were the entire content of the subject, and each is tempted, on the other hand, to adopt a partial explanation of human conduct and apply it too widely. In other words, there are "schools" of psychology, rather than a science; and the naïve inquirer finds himself as much puzzled by the various points of view as a Chinese student of Christian religion when confronted with two hundred sects.

Again, the majority of textbooks are not written for the voluntary student, the intelligent, mature layman who is led to the subject by an already aroused interest. They are either designed for college students who have signed up for a course, and who will, therefore, have to stick to it through thick and thin, whether it interests them or not, or else they are written for other psychologists in lingo which goes way over the head of a merely educated man. The voluntary student can voluntarily drop the subject. Therefore, a book worthy of holding his attention will begin with his initial interests — the practical incentive side of the subject and gradually work back into an analysis of fundamentals. The layman approaches psychology, if at all, because he is interested in complex human conduct. He wants a better explanation of the motives underlying it, in order that he can better predict the effects of his own actions on others. To get a sufficient explanation to be of help, of course, he must be initiated into elementary things which are so simple, viewed by themselves, that they explain nothing about conduct. But, before he gets into those details, he needs to be led along gradually, from applied mental formulæ to mental phenomena, from complex motives, then, to dominant motives, and from these back to basic desires, inherited tendencies, and physical traits and impulses. He wishes to be led from the known to the unknown.

What he gets, however, when he approaches an elementary textbook, is a preliminary discussion of "receptors," "stimuli," "the cerebro-spinal system," "the neurones," "synapses," and other unintelligible terms, which seem to have no bearing upon conduct. If he stays by the subject until he obtains some understanding of these items, he is likely to forget why he took it up; and, like as not, the author never arrives, even at the end of the book, at any discussion of everyday problems.

There are, it is true, many writers who ignore all of these fundamentals and leap directly into vital questions. And they do get themselves read. Generally, however, they neglect the basic facts of psychology because they don't know them. Even a layman feels the insubstantial character of their assertions. I have my own particular black-list, of fair-seeming, delightful books that mislead the unwary. Semi-religious, semi-new-thought, semi-scientific essays head the list. "How to be Good, though Human," "How to Get Results without Action," "How to Win God without Worship," might be representative titles of this type of book. The shelves are laden nowadays with so-called psychological books that seem to promise something for nothing — mere mental witchcraft. Consider for a moment the purport and promise of such literature. Fancy a nation sitting down in a still unconquered continent, and all seeking riches in a time of depression and health in a time of pestilence, by muttering, "I am abundance; I am all-power, I am all-strength!"

Next on the black-list comes the type of applied psychology which deals with the subject as if it were a bag of tricks or mechanisms, to be utilized without understanding, first in one field and then in another. Psychology, for instance, *does* apply to the law, to court procedure even, but not as this type of psychologist would have it, not mainly as a third-degree routine for tricking criminals into betraying themselves, but rather as a discipline for understanding and curing wayward impulses. It does apply to advertising and selling, not mainly as a form of hypnotic suggestion to persuade consumers to buy what they don't want, but rather as a means of eliminating wasteful misunderstandings of popular desires and needs. It does apply to factory management, not mainly as a smart propaganda for getting workers to give more than they are paid for, and to cheer for bosses whom they ought to detest, but rather as a help in the redistribution of human talent, and as an aid to the conservation of natural human happiness.

Finally, there is another section of the blacklist reserved for psychologists whom I cannot understand. There are reputable texts written by famous authorities that manage to obscure the subject of the human mind as thoroughly as if they were discussing the inward thoughts of Buddha. They use plain English words in as unintelligible an arrangement as a free-verse poem. I have before me a text on human nature and conduct which philosophizes for three hundred-odd pages about conduct, without mention of a single case of human activity. The reader, to follow the author's conclusions, must supply from his own imagination all the subject-matter under discussion! In this instance, the author, an admirable and inspiring personality, with a penetrating insight into the mind and a highly creative intellect, obscures himself from the man in the street, like the sun behind a London fog.

When it is possible to find so many kinds of psychologies, therefore, as I have indicated, the layman's request for advice in the selection of a text is well-advised. It seems probable that the readers of this discussion on accidents will, in the majority of cases, be unfamiliar with modern psychologies. Safety men, foremen of departments, students of industry, employment managers, and others who are interested in accident prevention are not generally informed on the subject, particularly since Professor William James ceased to write. For such inquirers, therefore, as a fellow layman, and with more than apparent reluctance, I offer my own opinions on the subject.

A briefer course in psychology. If a single book is demanded, I know of no clearer and more acceptable text than Professor Howard C. Warren's "Human Psychology." An alternative suggestion worth considering would be Robert S. Woodworth's "Psychology, A Study of Mental Life," which makes a similar approach in a simple and readable way. It is somewhat less comprehensive, however, than Warren's text, which offers intelligible explanations for a wider range of facts about behavior than any one other book I have seen. Doubtless it is a bit of a transition phase. Warren touches hands with William James, of the older, introspective psychology, upon the method of which it relies mainly for its *description* of mental phenomena. On the other hand, it seems to depend for its *explanations* of these facts, not upon what one learns by looking into one's own mind, but upon what we conclude from the study of others. In this it accepts also the method of inquiry developed most fully by Professor John B. Watson in his "Psychology from the Standpoint of a Behaviorist." This method emphasizes the physiological side, and draws its conclusions from external observations.

This two-angle approach of Warren's is of great value to the voluntary student because the layman knows the mind, if at all, chiefly from the introspective view, and a description which uses familiar concepts about the mind makes it easier to follow the author into the explanations. These may then be in any vocabulary the teacher wishes to employ, for we have fewer preconceptions about what actuates the mind and of what it is constituted. Professor Watson, a 100 per cent behaviorist, finds that he "can get along without such terms, in good repute, as sensation, perception, attention, will, image, and the like." The reader, however, unless he be already familiar enough with psychology to be interested in a special treatment of it, cannot dispense with such thoroughly domesticated terms. The behavioristic psycholǫgist in course of time may render them superfluous, but at present they are the only means of contact with the lay mind. Watson may be the psychologist of the future, but if so, then Warren and Woodworth are his prophets; they give the student the signs, grips, and passwords to the first degree in psychology.

Let me hasten to say of Warren's and Woodworth's books, however, that, while either of them fills most of the requirements of a single book study of the subject, each is, nevertheless, as an answer to the voluntary student's query, disappointing in two respects. They do hold off the layman in his quest for explanations of behavior by a long, initial description of the physiology of response — the nervous system, the special senses, etc., and they do stop far short of any adequate discussion of conduct. They take most of their space to analyze and then build up the complete mind. Only one eighth of Warren's text, and only one chapter of Woodworth's, is devoted to a description and explanation of attitudes, personality, character, and organized mental life, which are the sources of the layman's initial interest in the subject. Little is given us about the energy of the mind — the innate drive of desires, emotions, and feelings which represent the individual's momentum in life. Almost no hint is furnished as to how the mind adapts itself to the instigations or repressions of people, institutions, and conditions in the environment. The whole problem of adjustment, the accommodation between individual purpose and external factors, is left untouched.

There is a good recent book devoted almost wholly to this part of the story, which Warren and Woodworth deal with so lightly. In "The New Psychology and Its Relation to Life," A. G. Tansley gives a readable summary of the modern theories advanced to explain conduct.

This book has been very much praised, and has quickly run into five editions. It is suggestive, at least, and, if the cautious reader will consent to take on one more book, perhaps this ought to be the second one. I am bound to say, however, that it reveals a very "classical" attitude toward the physical basis of the mind. It clings to the old idea of the dualism of mind and brain, and treats the mind as a thing separate from the physical organism — "a self-contained entity, with its own laws, distinct from those of the brain and nervous system." It considers the mind as "possessing structure, activities, distinct parts and functions, because that is the only way in which we can proceed to find out about it." It seems to be rather the way *not* to find out about it. But let that pass; for the value of Tansley's book is not in its explanations, but in its descriptions in the field of motivations. Behavioristic psychologists usually stop short of treating social conduct thoroughly because they have not seen their way clear to explain it. They cannot reduce it to the simple, physical terms which answer for responses to the natural (impersonal) environment. Dr. E. B. Holt, in his book "The Freudian Wish," makes a valiant attempt to do so, but the basis for the attempt seems to be not yet safely established. For this reason, in regarding the mind and body as separate things, with separate functions, Tansley may be as dualistic as he likes, without any one's being able to controvert him. He passes over that section of psychology, the responsive equipment, in which dualism would be confusing, and gives his attention to the active faculties. Here the bodily changes and responses are not always made evident to observation, and the phenomena are chiefly known through introspection, or through mutual confidences. It is entirely legitimate to prospect into the little understood, imperfectly explained reaches of the mind by first sounding our own consciousness, and to let the physiological proofs and explanations come along as they can. Professor James, for instance, first, by subjective processes, described the influence of emotions upon energy output. Later, Dr. Cannon[1] came along with his labo-

[1] Walter B. Cannon, M. D., *Bodily Changes in Pain, Hunger, Fear, and Rage.* Philadelphia. 1915.

ratory studies of the glands of internal secretion, and explained the effects of emotions upon the secretion of adrenalin, and the stimulating effect of this chemical upon the circulation. Here was a definite step by which one aspect of psychology was taken over, in part, from the subjective to the behavioristic mode of interpretation.

There is no great difficulty for the student, therefore, in reading two books on psychology of such different approach as those of Warren and Tansley. The one analyzes the mind in its simple physical elements, and treats of its responses mainly to impersonal stimulus — things seen, heard, touched; and, when it deals with personal relations, considers mainly the permanent physical impressions taken from these contacts — the development of instincts and the formation of habits. The other book considers the personal relations at the moment of contact and the manner in which the inherited modes of response, instincts, and habits come into play. It lays particular stress upon the internal drive of the human organism to achieve certain selfish purposes, exercise the sex impulse and otherwise carry on the vital functions abundantly. To lay the two books side by side in this fashion is all that is required to make clear the fact that neither treatment of psychology is complete without the other.

If the reader can be led patiently to absorb the rounded view of the mental life gained by these texts, he will have acquired a workable theory of psychology and may begin to make his own applications in a limited way. His use of psychology will be sounder on this foundation of general knowledge than any parrot-like adoption of particular mechanisms of "applied psychology," such as mental tests, or the revision of advertising copy in accordance with a list of presumed human "instincts."

The full scope of psychology. It is to be hoped, however, that, when he has come thus far, the student will recognize that the instruction which he can get from any two books is not sufficient for a subject which attempts to explain all of the reasons for human conduct. He should contemplate a longer and still more thorough-going treatment of the subject. For

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The first of these affirmations is dealt with chiefly by what is known as "genetic psychology" — a study of the origin of the mind. The second is partly covered by the term "descriptive psychology" — the study of the present condition of the mind. Relative to the third, at present, there is no recognized branch of psychology dealing solely or adequately with the energy of the mind, although the psychoanalysts — the Freudian school — were the first to emphasize the significance of positive, inherent impulses. We shall call this "dynamic psychology."[1] The fourth affirmation is dealt with by two main subdivisions of inquiry, "social psychology," which is the study of normal adjustments and conduct of the mind, in contact with other people, and "abnormal psychology," which is a description of the by-ways and effects of maladjustment. There is need of an inclusive treatment of the two branches

[1] Professor R. S. Woodworth dealt with a portion of the field under the title of "Dynamic Psychology" (New York, 1918), a development of his Jesup Lectures for 1916–17.

under the term "adjustment psychology"; for, strictly speaking, while there may be abnormal relations, there is no abnormal psychology. The best treatment of adjustments is usually found based upon premises concerning dynamic psychology, in writings on psychiatry, which, as a science, began by being something much more restricted — a study of insanity from the medical point of view. As psychiatry passed over from helpless classification of the types of mental disease to open-minded efforts at prevention and cure, it extended the scope of its inquiry, until now it embraces more of psychology in its purview than any other one branch, and it heads up with emphasis upon adjustment, under the term "mental hygiene."

Let us briefly consider some of the aspects and literature of each of these four main branches of psychology.

Relative to the origin of the mind, one can get in a single chapter of Robinson's "The Mind in the Making" a good picture of the effects of the evolutionary history of the mind. He pictures the animal, savage, infantile, and traditional phases of the mind, which antedated creative thinking, which still exist in our minds, and which generally influence us more definitely than do direct observation and reasoning. Those who wish to pursue this subject more deeply may read William MacPherson's "Psychology of Persuasion" and L. T. Hobhouse's "Mind in Evolution." For a study of animal psychology, the layman is likely to find most interest in reading a book such as William T. Hornaday's "The Minds and Manners of Wild Animals." It is defective in its basis of human psychology — it even reveals the author's acceptance of phrenology — but we may safely read his accurate observations, based upon unusual facilities. There is less interest in a more authoritative text, such as S. J. Holmes's "Studies in Animal Behavior," or C. L. Morgan's "Animal Life and Intelligence."

A useful and generally fascinating treatment of the development of savage ideas and customs will be found in William I. Thomas's compilation of papers under the title "Source Book for Social Origins." It treats of the influence of geography, of the nature of the mind of primitive man, and of the beginnings of invention and technology of customs of sex and marriage, of ideas of art, ornament, and decoration, and of the institution of religion, social organizations, morals, and the state. To round out the appreciation of mental evolution acquired from such texts as the preceding, one should give consideration to the continuing effects of the material environment, in the present day, by studying such a work as Maria Semple's "Influences of Geographic Environment," or the more recent, more popular, "Human Geography," of Huntington and Cushing. A valuable summary of several branches of genetic psychology is Carl Kelsey's "The Physical Basis of Society."

On the subject of "descriptive psychology," it is important first to say that it tends to be always less concerned with mere description. Its development is away from self-conscious analysis, of a philosophical nature, and in the direction of conformity with the general body of physical sciences — physics, chemistry, and physiology. It aims to bring psychology under universal laws. In order to be prepared adequately to understand such texts on descriptive psychology as those of Warren and Watson, which I have cited, one should know something of the more basic sciences. A good deal of what the psychologists need in these departments may be found in Professor Ernest N. Starling's "Principles of Human Physiology," a monumental work of delightful readability, and one which seems adequate and modern as a physiology, from every point of view. Probably, in future, there will be a good deal more attention given to the ductless glands than even Starling pays to them, but at present we must look for adequate study of these important stimulators of mental activity to specialized texts such as Bandler's "The Endocrines." The layman is likely to be most easily interested in the ductless glands by reading Berman's sensational essay, "The Glands Regulating Personality." The experts decry it, as partly fictitious, partly pure assumption, but it has a value for the average reader who needs to have his scientific literature seasoned a bit. I am quite sure that Berman will at least put the word "gland" into the average vocabulary.

The novice may, also, be unreservedly referred to one book which treats physiology briefly, authoritatively, and readably. Dr. Arthur Keith's "The Engines of the Human Body," although written by one of the foremost medical men of England, sets out to tell, not in technical medical terms, but rather in those of the mechanical engineer, something of the creative work of the body. He treats it "not in a series of fragments, but in its entirety — as a complete, living and moving machine." The effort is a notable success.

The manner of the body's relation to mental life, as the layman understands it, is most clearly appreciated by study of the brain and the nervous system; especially by a study of the special senses. The merging of the studies of physiology and psychology take place in so-called "experimental psychology" — which is largely a study of the special senses. C. S. Myers's "Text Book" on this topic is one of the best for the voluntary student, for it is not wholly unmindful of the applications of its studies to practical affairs.

In connection with the descriptive and behavioristic study of the mind, it is helpful to stop to give special attention to defects of heredity and growth which result in feeble-mindedness. So large a percentage of the population is dwarfed in its capacity for good citizenship by limitations of mental development that it is highly important for us to understand what are the characteristics of the mind which are likely to be shared by persons of all mental levels, and what ones are omitted from or arrested in the minds of the deficient. The stigma of deficiency is settled on the basis of the Binet-Simon tests for mental age, or some adaptation of them.[1]

[1] It seems probable that the tests themselves are based upon too limited a view of what constitutes the mind. Dr. Henry C. Link feels, indeed, that the tests reliably measure only ability to pass the tests, and that intelligence is to be gauged rather by an individual's capacity to effect a satisfactory adjustment to his life and his job. This, however, is not legitimately an alternative to, but a partial correction for intelligence tests. For it depends upon the phase of life to which a mind is adjusted to say what degree of intelligence is indicated by the adjustment. Different occupations, different family responsibilities, different environments, make different demands upon the personality. No one is "adjusted to life" — he rather strives to find the corner or character of life to which he is congenial. A contented moron may be better adjusted than a genius, but not, thereby, more intelligent.

The layman interested in the civic effects of low-grade mentality is advised to read Dr. H. H. Goddard's "Human Efficiency and Levels of Intelligence," a provocative little book. Those desiring to know something more of the present development of tests should look at Lewis M. Terman's "The Measurement of Intelligence." Dr. Goddard's work, "Feeble-Mindedness," dilates on some of the causes of mental deficiency, but I have not yet seen an adequate treatment of the subject from the point of view of the physical and the sensory equipment of the feeble-minded; and from the point of view of what the feeble-minded of different mental ages share with people normally developed, in terms of analytical psychology. What, in mental terms, is the greatest common denominator? Such a study would be highly valuable to industrial managers, teachers, statesmen, editors, and others who wish to bring the largest available amount of useful ideas to the minds of the great masses of "dull normal" people. A nearly satisfactory book on all these aspects of feeble-mindedness is Leta Hollingworth's "The Psychology of Subnormal Children."

Neither have we yet available any proved method of scaling emotional stability or responsiveness, or of gauging native differences in temperament, by test. Professor June E. Downey, of the University of Wyoming, has devised some individual "will-temperament" tests, but they have not yet been widely tried out and her book on the subject is still in press.[1] In short, the great work of classifying likenesses and differences between individuals in respect to their native equipment lies before us. With such omissions, descriptive psychology is hardly prepared yet to call itself truly descriptive. At present it merely partly describes, and but partially explains, how a normal organism is likely to respond to selected types of stimulus. What characters are most deeply and universally ingrained in the mind, what are the indications and bases for superior intelligence, and what are the measures and evidences of individual variations, it passes over lightly.

The greatest omission in what usually passes for psychology, however, is the failure to consider the positive energy of the mind, and the

[1] World Book Company.

significance which it holds in explaining human conduct, human emotions, and human happiness.

It is, perhaps, admitted that the body has energy which is derived not from external stimulus to action, but from its own processes of metabolism. But the identity of the mind and body seems to be forgotten by many psychologists when they consider mental energy. Obsessed by the doctrine of *determinism*, the classroom psychologist fears to contemplate the mind as an active, originating force, lest to do so might seem to lend support to the notion of *free will;* so they consider the mind as if it were a kind of coiled spring, capable of acting only when it is stepped on. They speak of reflexes, habits, and instincts as "modes of response," merely, and not as also pathways of action. The propulsion, the emotional drive, which results from such healthy, active desires as hunger, sex craving, and the impulse for mere bodily movement and exercise, is glossed over.

The concentration of the psychologist upon "modes of response" causes him to neglect to analyze psychic manifestations which may be regarded as "modes of action" — dancing, sport, work, play, drama, music, art — which vary with individuals in proportion to their native endowments and cultivated energies, quite as sight, hearing, pain-sense, reflexes, habits, instincts, and other so-called modes of response. Indeed, a habit is equally the result of self-originating action as of response to stimulus. All of the true instincts are energy-releases of active organs which inherit the tendency to discharge their energy in a certain way. Most of the so-called instincts are probably complex habits formed after birth, and associated with primary instincts as acquired modes of action. Since they carry with them the satisfaction accompanying discharges of energy, they come in course of time to have an apparent energy of their own. Probably this is what leads Professor William McDougall to base his "Social Psychology" almost wholly upon a certain repertoire of instincts which he distinguishes as customary modes of action. Personally, I consider most of his so-called instincts merely as easily formed habits, commonly associated with basic instincts. Many of

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and in Dr. William A. White's "The Foundations of Psychiatry," and the same author's "Principles of Mental Hygiene," all the texts he will need to complete his survey of the full scope of psychology.

THE END